February 17, 1958 75 Cents

AVIATION WEEK

A McGRAW-HILL PUBLICATION

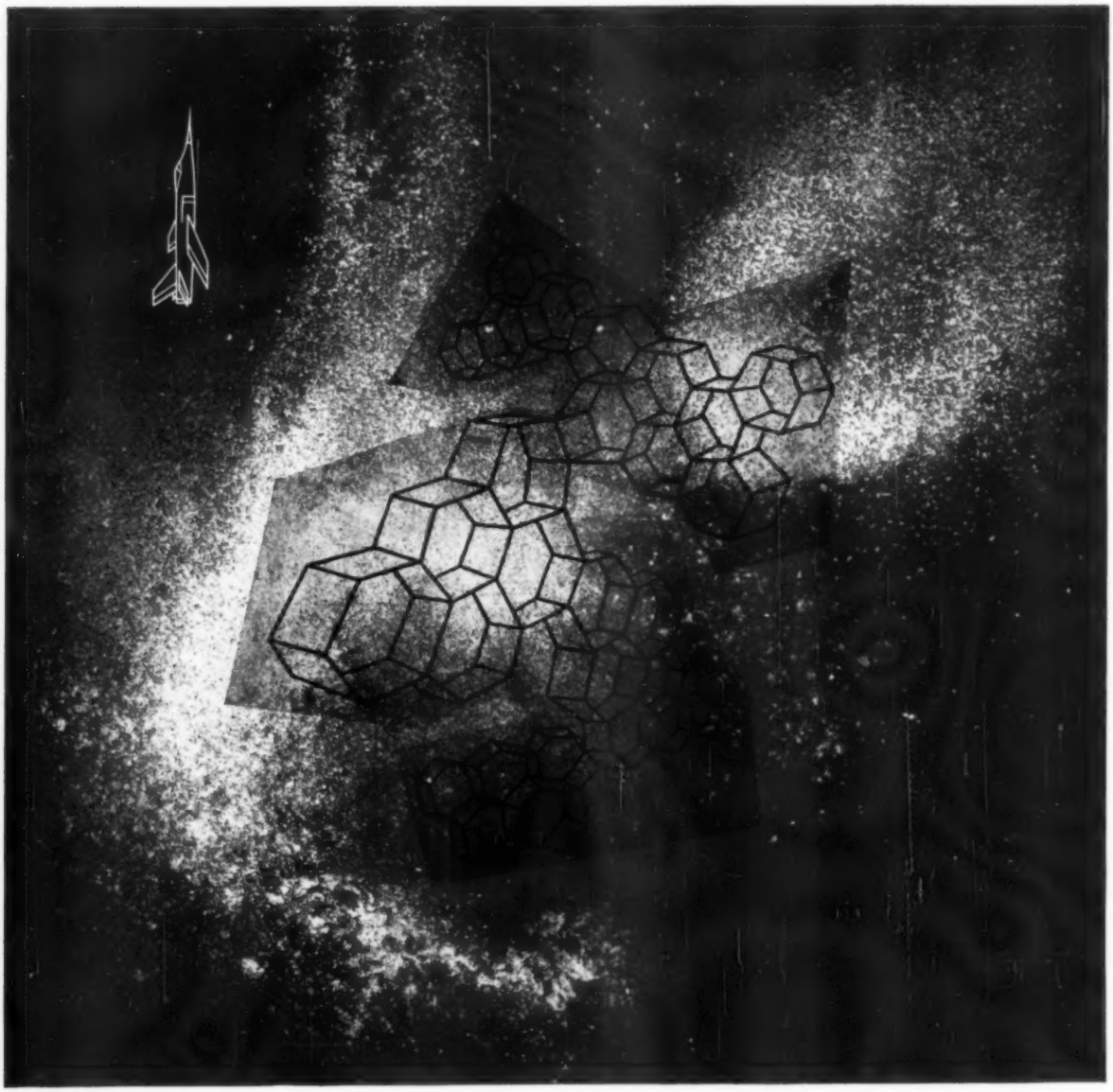
New Details on Russian Tu-114

•

Sperry Bearings Cut Gyro Drift

Sperry Gyro Rotorace

PAGES FROM AN ENGINEER'S WORKBOOK



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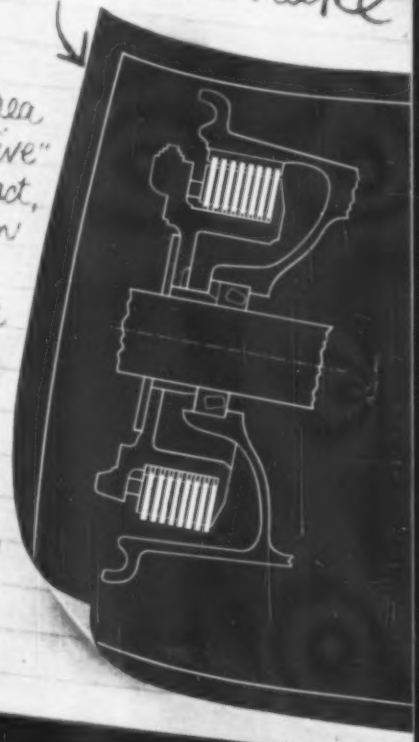
Large contact area with an "all-active" heat sink; compact, meets specification capacities in less space. Fewer parts. Fewer man-hours required for overhaul—impressive weight-savings!



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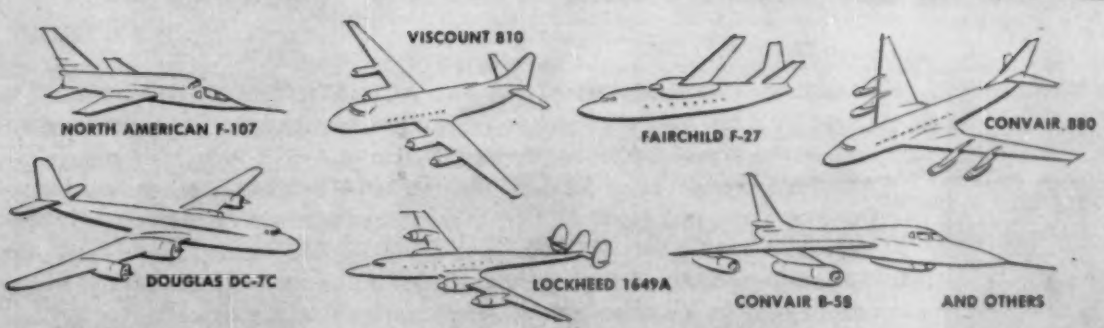

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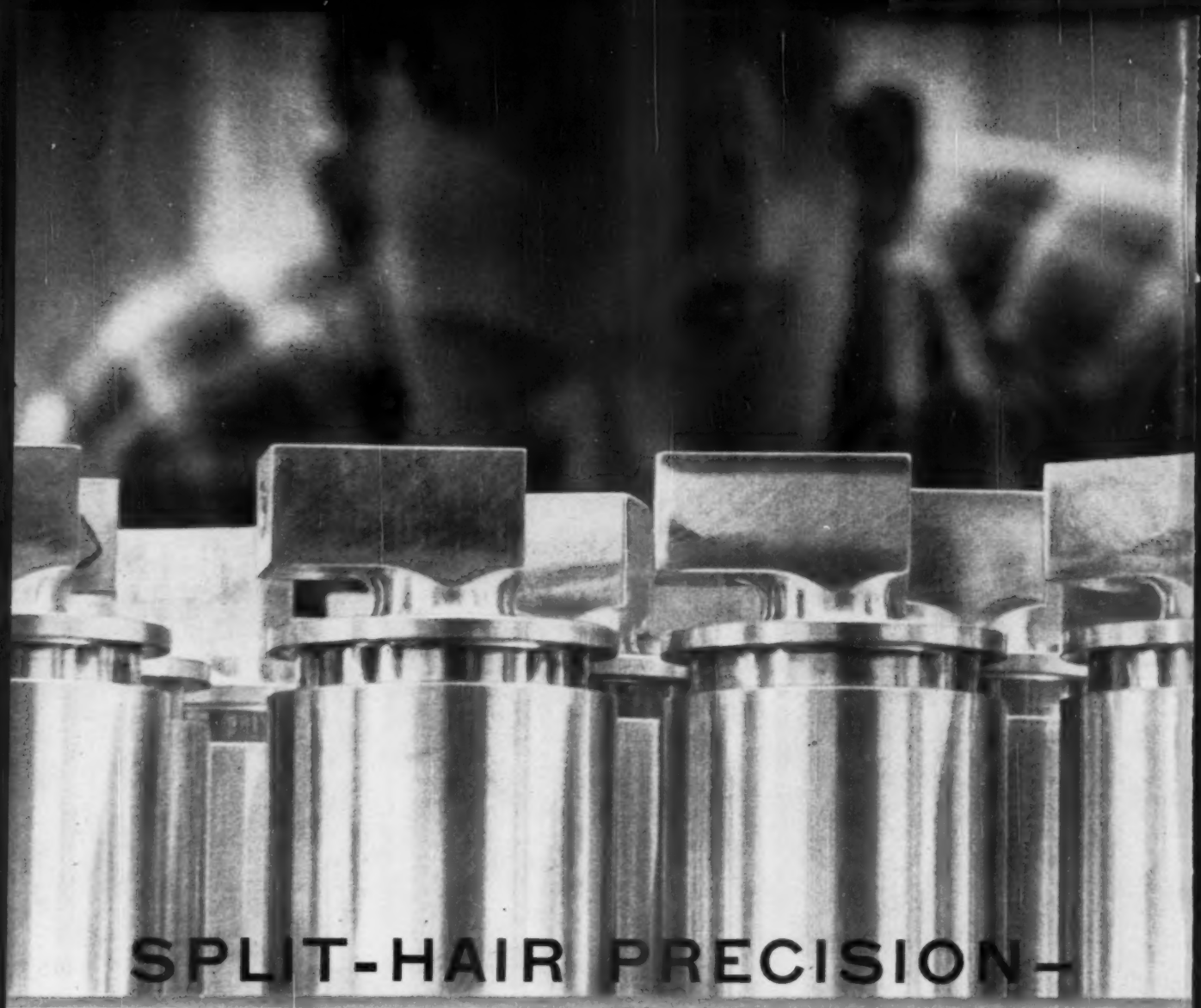

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AVIATION CALENDAR

Mar. 3-6—Third Annual American Society of Mechanical Engineers Gas Turbine Conference and Exposition, Shoreham Hotel, Washington, D. C.

Mar. 4—"The Long History of Space Travel," Dr. Willy Ley, The Franklin Institute, Philadelphia, Pa.

Mar. 4-6—Sixth Annual Air Line Pilots Assn. Air Safety Forum, Hotel Shoreland, Chicago, Ill.

Mar. 5-6—Second Annual Shock Tube Symposium, Palo Alto, Calif. For details write: Commander, Air Force Special Weapons Center, Kirtland AFB, N. W., Atten.: R. R. Birukoff, SWRS.

Mar. 13-14—Institute of the Aeronautical Sciences, National Flight Propulsion Meeting (Secret clearance required), Hotel Carter, Cleveland, Ohio.

Mar. 13-14—Fifth Annual Heat Transfer Technical Conference, Oklahoma State University, Stillwater, Okla.

Mar. 13-14—Second National Conference on Aviation Education, Hotel Mayflower, Washington, D. C.

Mar. 17-20—Joint Aviation Conference, American Rocket Society-American Society of Mechanical Engineers, Statler-Hilton Hotel, Dallas, Tex.

Mar. 17-21—Third Colloquium, Combustion and Propulsion Panel, Advisory Group for Aeronautical Research and Development, NATO, Palermo, Sicily.

Mar. 17-21—1958 Nuclear Congress, 25 W. 45 St., New York City.

Mar. 17-21—14th Annual Conference, National Assn. of Corrosion Engineers, Civic Auditorium, San Francisco, Calif.

Mar. 17-27—International Aeronautical Federation, 51st General Conference, Los Angeles, Calif. For details write: International Aeronautical Federation, 6, rue Galilee, Paris 16e, France.

Mar. 18-19—Conference on extremely high

(Continued on page 6)

AVIATION WEEK • FEBRUARY 17, 1958

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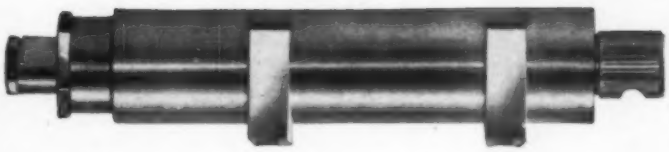
A FLUTTER DAMPER



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IS NOT JUST ANOTHER DAMPER

It MUST operate through minute amplitudes but be capable of moving through large amplitudes.

It MUST operate uniformly through extremely large temperature ranges.

It MUST dissipate energy at high frequencies which means that the dynamic spring* constant MUST be high.

It SHOULD be light in weight and of small envelope.

Through rigorous analysis CLEMCO has met the challenge of the aircraft and guided missile industry and now provides these industries with three basic damper sizes . . . EACH OF WHICH HAS THE GREATEST DYNAMIC SPRING CONSTANT, FOR ITS SIZE AND WEIGHT, EVER PRODUCED!

Outside Dia. (ins.)	Weight (lbs.)	Travel (deg.)	Damping Constant (in-lbs.-sec./rad.)	Dynamic Spring Const. (in-lbs./rad.)
1.50	2.94	60	0-600**	163,000
1.75	3.81	70	0-750**	235,000
2.00	4.60	95	0-900**	300,000

CLEMCO Flutter Dampers have integral housing abutments which mean fewer assembly parts and extreme reliability.
CLEMCO Flutter Dampers are light weight, rugged, simple in construction, and held to the finest of instrument tolerances to provide a performance tested product . . .

*The spring which is a part of the damper and acts in series with the damping force.

**Max. setting for optimum in-phase damping at frequencies of from 35 to 50 CPS.

CLEMCO AERO PRODUCTS, INC. are furnishing the leaders of the aircraft and missile industry with the following:

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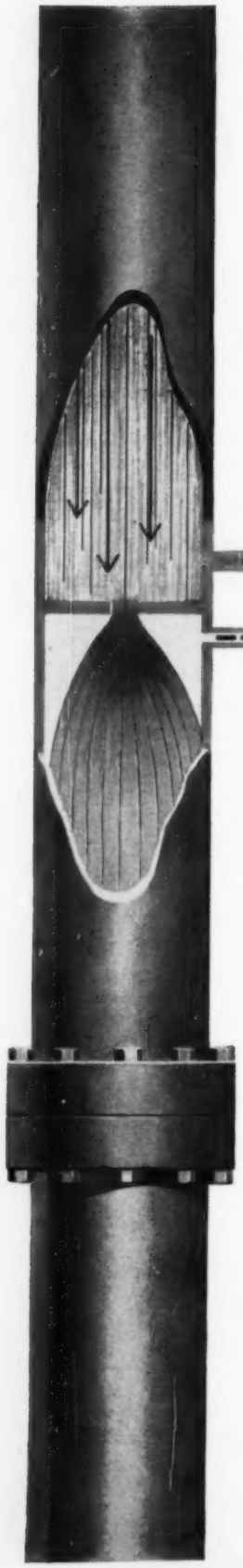

the pressure pickup *really* that can take it

If physical abuse is a problem in your application, consider CEC's *new* Type 4-322 Differential Pressure Pickup. With its unbonded strain-gage sensing element and diaphragm encased in a stainless-steel housing, the 4-322 will endure mistreatment that would cripple the average pressure pickup. The rugged 4-322 is available in pressure ranges from ±7.5 psid to ±50 psid and operates at line pressures up to 350 psi. Its compensated temperature range is −65°F to +250°F, and it may be operated from −100°F to +300°F without damage. Output at rated excitation is ±20 mv at full range pressure. Size is 1-9/16″ x 1-1/16″ x 1-1/16″. Weight: 181 grams nominal. For detailed information, call your nearest CEC sales and service office, or write for Bulletin CEC 1606-X1.

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RECOGNIZED LEADER IN GALVANOMETERS • TELEMETRY PRESSURE AND VIBRATION INSTRUMENTATION

AVIATION CALENDAR

(*Continued from page 5*)

temperatures (over 30,000K), sponsored by USAF Cambridge Research Center, L. G. Hanscom Field, Bedford, Mass.

Mar. 18-19—First Inter-Service and Industry Symposium on Guided Missiles Training Equipment (limited to those with Secret clearance), Naval Ordnance Laboratory, White Oaks, Silver Springs, Md. For details write Mr. J. G. Vaeth, Head of New Weapons & Systems Division, U. S. Naval Training Device Center, Port Washington, N. Y.

Mar. 24-26—Annual Meeting, Aero Medical Assn., Statler Hotel, Washington, D. C

Mar. 24-27—Institute of Radio Engineers, National Convention, Waldorf-Astoria Hotel and New York Coliseum, New York City.

Mar. 30-Apr. 1—RFC-RNAS Reunion (World War I), Toronto, Canada. Contact: C. B. Stenning, Chairman, 149 South Drive, Toronto 5.

Mar. 31-Apr. 4—American Management Assn., Management Methods for Professional People Seminar, Sheraton-Astor Hotel, New York City.

Apr. 8-10—Eighth International Symposia, Electronic Waveguides, Engineering Societies Bldg., 29 W. 39 St., New York City.

Apr. 10-11—Aeronautical Training Society Annual Meeting, Mayflower Hotel, Washington, D. C.

Apr. 10-12—Southwestern Institute of Radio Engineers Conference and Electronic Show, St. Anthony Hotel and Municipal Auditorium, San Antonio, Tex.

Apr. 16—"Inductive Testing Requirements of Contacts Used in Aircraft Electric Systems," M. Trbovich, Hartman Electrical Mfg. Co., Engineers Club, Philadelphia, Pa.

Apr. 16-19—14th Annual National Forum, American Helicopter Society, Sheraton-Park Hotel, Washington, D. C.

Apr. 17-18—Institute of Environmental Engineers, Second Annual Technical Meeting, New Yorker Hotel, New York City.

Apr. 22-24—1958 Electronic Components Conference, Ambassador Hotel, Los Angeles, Calif.

Apr. 28-30—Second Annual Astronautics Conference, sponsored by Air Force Office of Scientific Research and Institute of Aeronautical Sciences, Shirley Savoy Hotel, Denver, Colo.

May 4-7—Fourth National Flight Test Instrumentation Symposium, Park Sheraton Hotel, New York City.

May 12-14—National Conference on Aeronautical Electronics, sponsored by Institute of Radio Engineers, Biltmore Hotel, Dayton, Ohio.

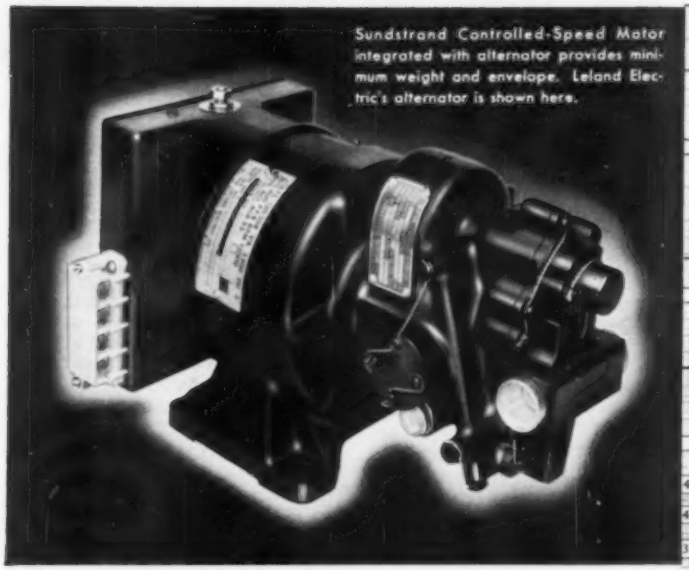
May 14-16—Spring Meeting, Society for Experimental Stress Analysis, Hotel Manger, Cleveland, Ohio.

May 19-22—17th Annual National Conference, Society of Aeronautical Weight Engineers, Inc., Belmont Plaza Hotel, New York, N. Y.

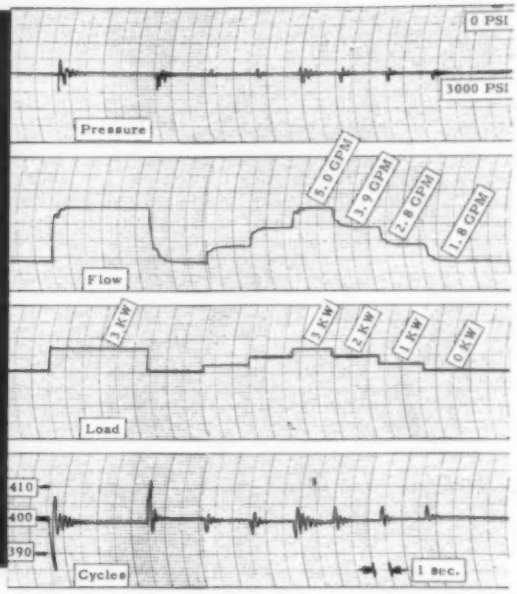
June 2-4—1958 National Telemetering Conference, Lord Baltimore Hotel, Baltimore.

June 9-13—Fourth International Automation Exposition and Congress, Coliseum, N. Y. N. Y.

New Electrical Power System for Missiles and Aircraft



Sundstrand Controlled-Speed Motor integrated with alternator provides minimum weight and envelope. Leland Electric's alternator is shown here.



Oscillograph trace of power-generating system performance with basic flyball governor. Governor trimming methods provide more precise control.

Operates off general hydraulic system, provides 4 kva rated power, capable of 100% overloads

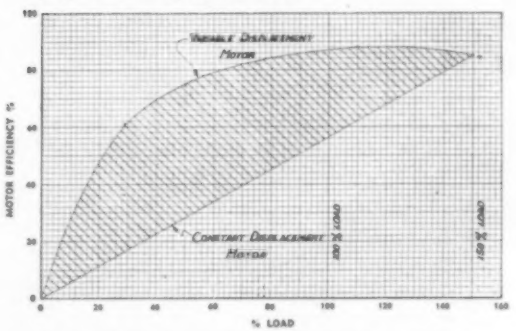
Use of a Sundstrand controlled-speed, variable-displacement hydraulic motor to drive a 400-cycle alternator provides an emergency and isolated electrical power-generation system with many desirable characteristics.

High efficiency throughout the operating range is assured because speed of the motor is controlled by varying the displacement to match the required torque output. The motor takes only that flow of oil from the general hydraulic system required to maintain the driven load. This eliminates the inefficient throttling necessary in a fixed-displacement motor system. There are no discontinuities in speed control from no load to full load.

The system is capable of handling 100% overloads for extended periods.

Integration of the motor in a common housing with the alternator provides minimum weight and envelope . . . maximum resistance to shock and vibration . . . and increased reliability. The integrated package also permits cooling the alternator with oil when air cooling is impractical.

The motor shown has a self-contained flyball governor. Models with external speed controls are available where variable speed is required. The motor itself is particularly suited to driving any load where torque requirements are variable and heating of hydraulic fluid is critical.



Efficiency advantage of variable-displacement motor over fixed displacement motor is shown for loads ranging from 0 to 150% of rating.

- **4 kva with 1.0 power factor**
- **-65° F to +275° F temperature range**
- **Higher temperature models available**
- **Speed control within ±1/10% with trim**
- **±1½% with self-contained governor**
- **One-second transient response**

Mail coupon for complete details.

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Sundstrand Aviation
2411 Eleventh St., Rockford, Ill.

Send complete data on controlled-speed motor.

Name_____
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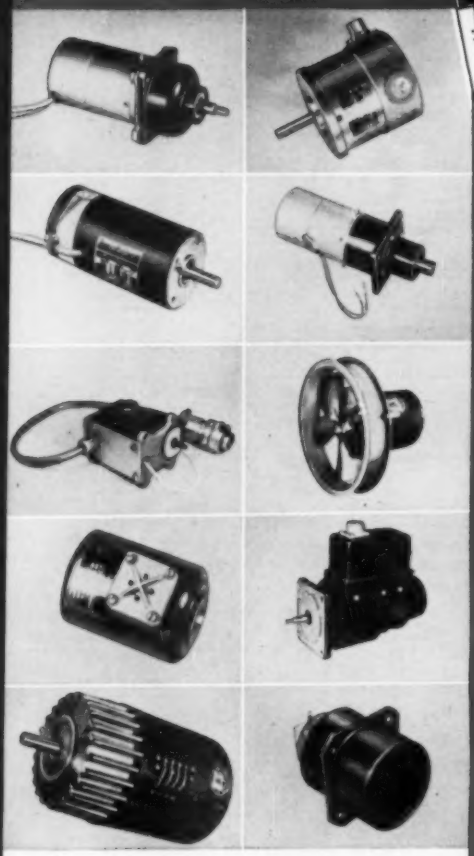
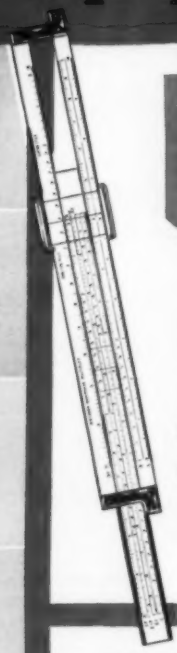
☐ Immediate Interest ☐ Reference

Here they are!

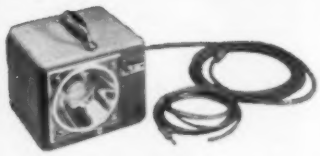
WESTERN GEAR answers to your electrical equipment problems...



Pictured above are only a few of Western Gear's complete miniature motor line, ranging from 1/500th to 4 HP. Choose from cycle ranges of 50 to 400 at any voltage required. Furthermore, if our basic designs do not meet your particular requirements, our engineers will be glad to work with you on your rotary electrical problems WITHOUT OBLIGATION!

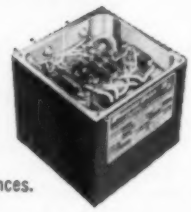


LABORATORY-TYPE POWER SUPPLY— New from Western Gear, Electro Products Division, is this lab-type, voltage-regulated power supply, available in either cabinet or rack type mounting. Input voltage is 105 to 125 volts at 50 to 60 cycles per second. Three output voltages are available . . . continuously variable 0 to 300V DC at 150 MA; continuously variable 0 to negative 150V DC at 5 MA; and 6.3V AC at 8 amperes. For full information, use the coupon below.



STROBOSCOPE UNIT— Now available, a reasonably-priced, compact, true-color stroboscope for viewing rotary, reciprocating or repetitive motion, as designed and manufactured by Western Gear's Electro Products Division.
SPECIFICATIONS: Flash duration, 10 microseconds; light output, 5 Lumen seconds per flash; repetition rate, 0 to 100 pulses per second; dimensions, 6" wide, 5" high, 5¾" deep.
For complete information, mail the coupon below.

TRANSISTORIZED VOLTAGE REGULATOR— Rugged conditions are made to order for this precision unit, especially where performance, space and weight are of extreme importance.
The circuitry employs a shunt power transistor and a temperature-compensated Zener diode reference voltage. Input voltage is 31V DC plus or minus 4V. Output of the 7VR12 is 5V DC at 100 to 200 MA. Regulation less than plus or minus .1 per cent for combined variations of input voltage, load current, temperature, drift and vibration. Dimensions 2 x 2 x 2. Weight 8.5 ounces. For more of the story, check and mail the coupon below.



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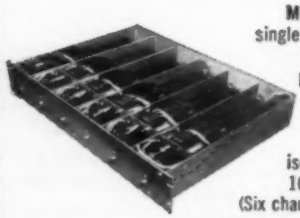

MULTIPLE CHANNEL STRAIN GAGE POWER SUPPLY— Model 7P01 single or multiple channel strain gage power supply, 115 V, 60 cycle input, 10V DC output, adjustable from 9-11V DC with a 10-turn potentiometer. Output voltage changes less than plus or minus .05% due to temperature change from 0 to 45°C; output voltage changes less than .1% due to 2% change in load current. Output ripple is less than 300 microvolts RMS, isolated from ground as follows: insulation resistance to ground, 10,000 megohms; AC pickup voltage to ground, 5 microvolts peak. (Six channel unit shown.) For complete information, mail coupon below.

Glenn Malme • WESTERN GEAR CORPORATION • P.O. Box 182, Lynwood, California

Please send information checked:

- ☐ Motor Catalog No. 254-A
- ☐ Data sheet on Voltage Regulator
- ☐ Data sheet on Strain Gage Power Supply
- ☐ Data sheet on Lab-type Power Supply
- ☐ Data sheet on Stroboscope Unit

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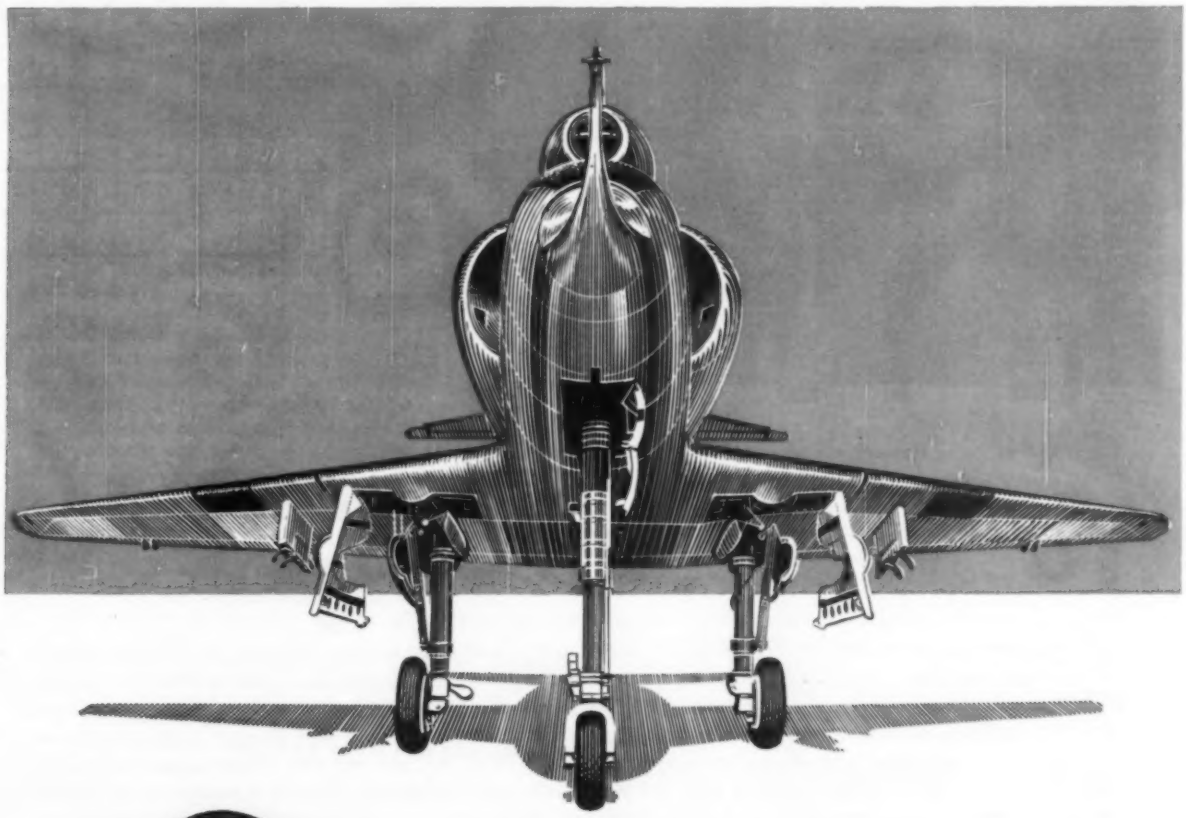
. . . *Because* MENASCO USES ADVANCED METHODS IN THE MANUFACTURE OF BANTAM LANDING GEAR

DOUGLAS A4D-2 *Skyhawk*, smallest and lightest jet combat plane operates from all sizes of Navy carriers and short landing fields. Nicknamed the *"Mighty Midget,"* this powerful bantam attack plane is the latest in design simplification and efficient functional performance. Capabilities include carrying atom bombs, rockets, missiles, machine guns and other weapons.

MENASCO was chosen to fabricate the compact, lightweight, rugged landing gear required to meet the highest mechanical specifications. Compatible with the design pattern, MENASCO used the most economical, yet most effective and practical fabrication techniques to provide low cost high volume. This is typical of the imaginative thinking which applies to Menasco's production planning.



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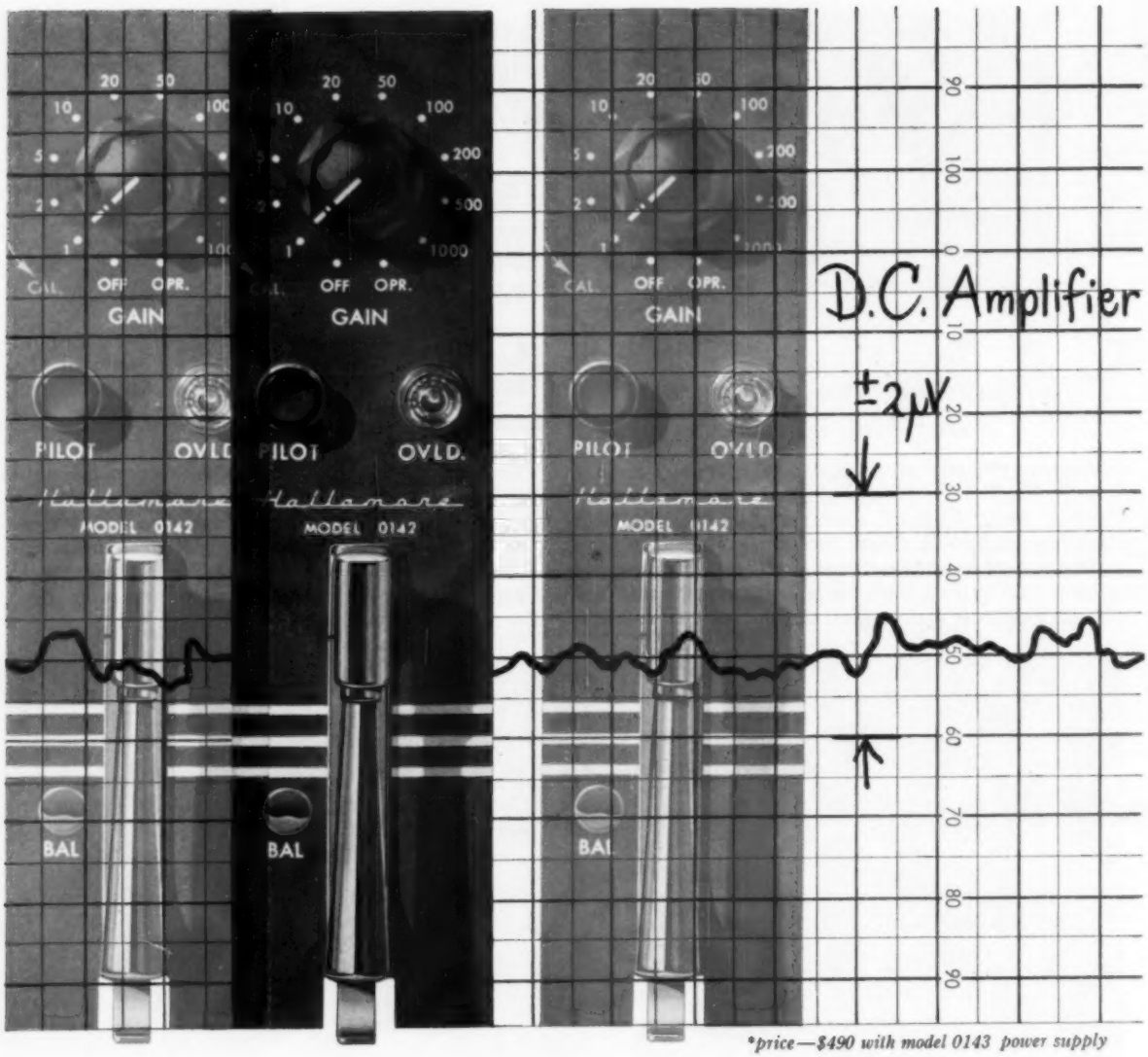
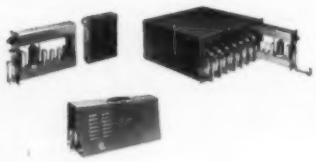


*price—$490 with model 0143 power supply

WIDE CAPABILITY... HIGH DEPENDABILITY



NEW HALLAMORE DC AMPLIFIER The combination of low drift and noise with high stability and broad bandwidth constitutes an instrument very nearly ideal for applications requiring the amplification of DC signals. The Hallamore Model 0142 affords DC gain accuracy of 1% or better and DC gain stability of .05%, with a drift of less than ± 2 microvolts, referred to input with 10% regulated line. Applications include telemetering, data handling and process control. The unit is also employed as an oscilloscope pre-amplifier, galvanometer driver, or error amplifier. Model 0142 is immediately available as a plug-in unit or as an element in a module of eight amplifiers with eight Model 0143 power supplies or one Model 0144 regulated power supply. For general laboratory use, the amplifier has been combined with a Hallamore power supply in a convenient, portable cabinet, Model 0146. Write or phone for PUB 543, full description of Model 0142 DC Amplifier. Address: 8352 Brookhurst Avenue, Anaheim, California.

HALLAMORE ELECTRONICS COMPANY *a division of the SIEGLER CORPORATION*

86

Another ARC Flight Proved Product

The Type 210 360 Channel VHF Transceiver. Now available—a high powered VHF Transceiver that permits two-way communication on ALL frequencies likely to be used for many years . . . choice of *any* required frequency for any part of the country, whether you fly under VFR or IFR conditions. Here is extra safety insurance for you and others on today's more crowded airways.

THE SYSTEM:

- **Frequency range: 118.00 to 135.95 mc**
- **360 channels, spaced 50 kc**
- **Weight of entire system: 22 pounds, compact size**
- **Operation: single channel simplex or double channel simplex by pilot selection**

TRANSMITTER:

- **Power output: 15 watts, high level amplitude modulation**
- **SCS/DCS: Transmitter can operate 6 mc higher than receiver in DCS position and on same frequency in SCS control position**

RECEIVER:

- **Sensitivity 2 microvolts at 10 db $\frac{S+N}{N}$**
- **AVC: 3 db, 10 to 10,000 microvolts**
- **Image rejection: over 70 db; all other spurious rejections over 80 db**
- **Automatic noise limiter**

Backed by 29 years of leadership in airborne electronic equipment exclusively, and over 18 months of laboratory and flight testing, the Type 210 assures you of ARC's well known exacting standards of engineering and quality manufacture.

Ask your dealer or write us for descriptive brochure.

Dependable Airborne Electronic Equipment Since 1928

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Miniaturized Automatic Direction Finders • LF Receivers and Loop Direction Finders • UHF and VHF
Receivers and Transmitters • 10-Channel Isolation Amplifiers • High Powered Cabin Audio Amplifiers • Interphone Amplifiers
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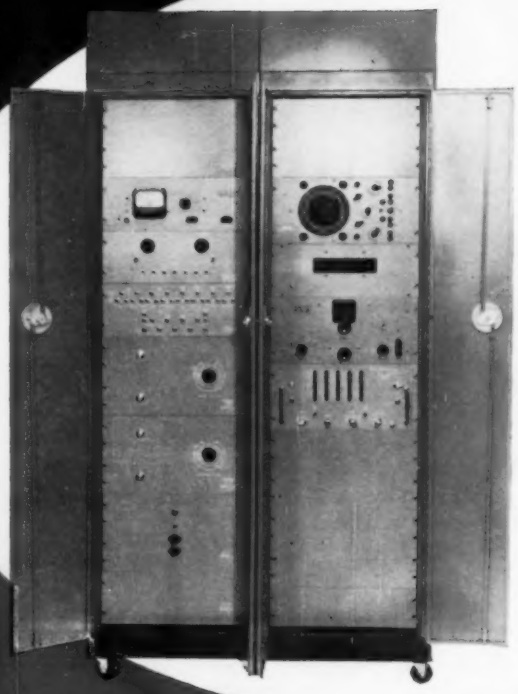

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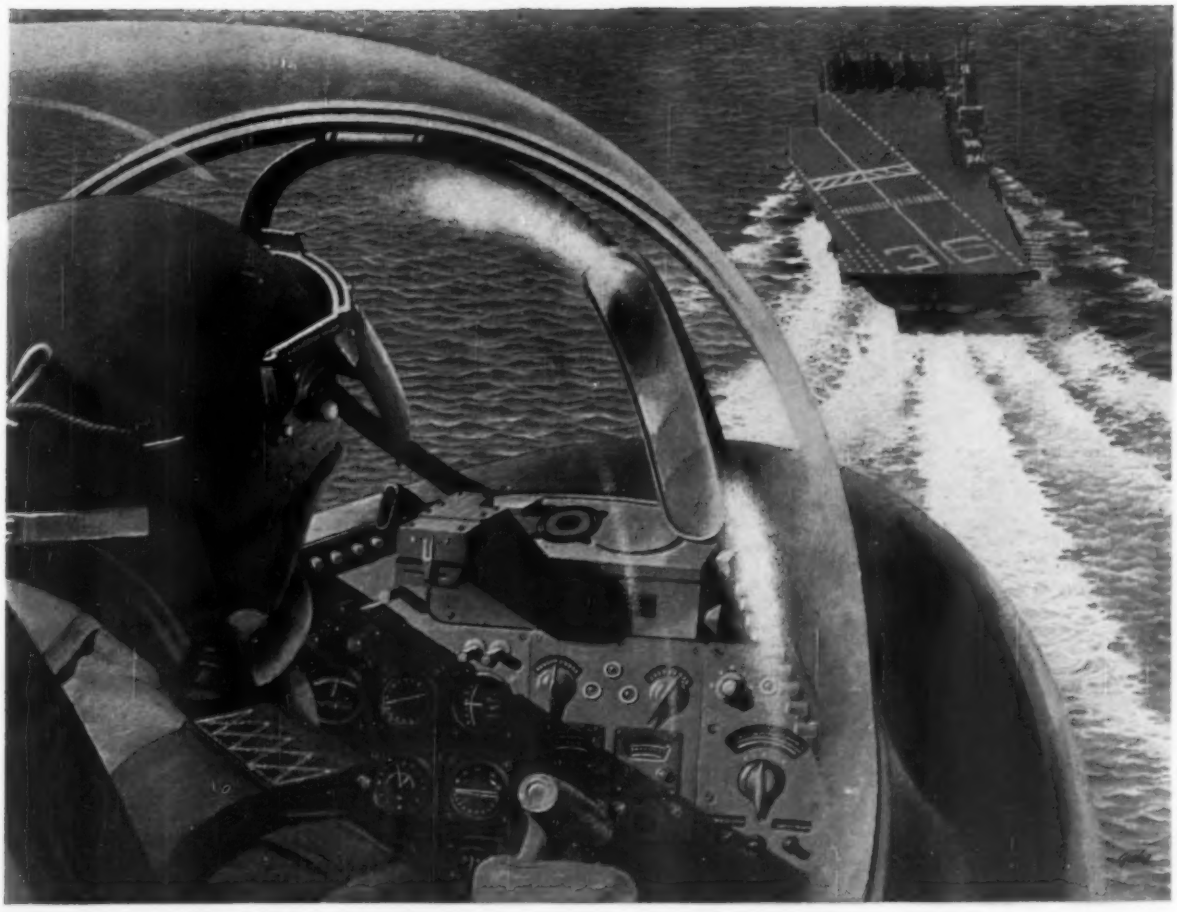

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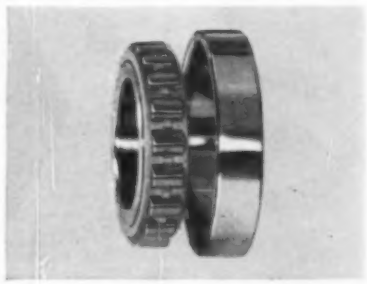

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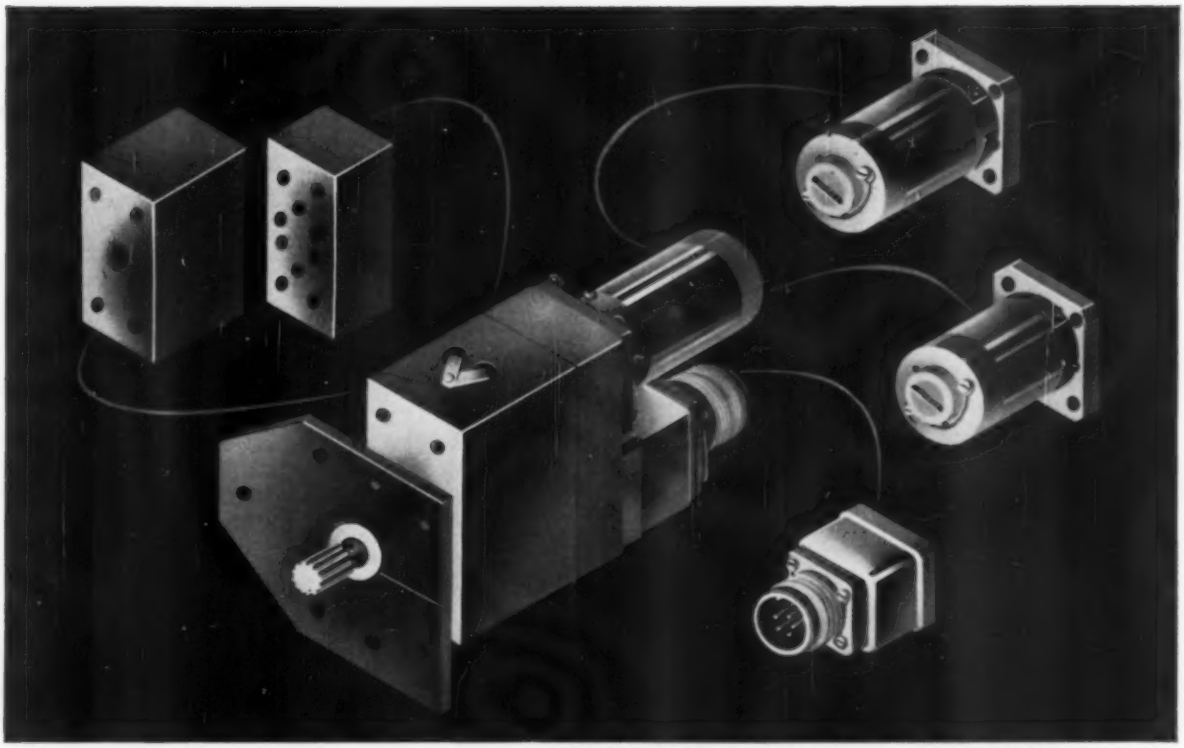

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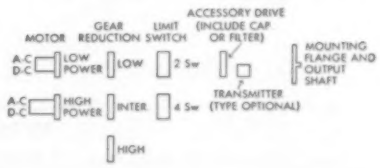

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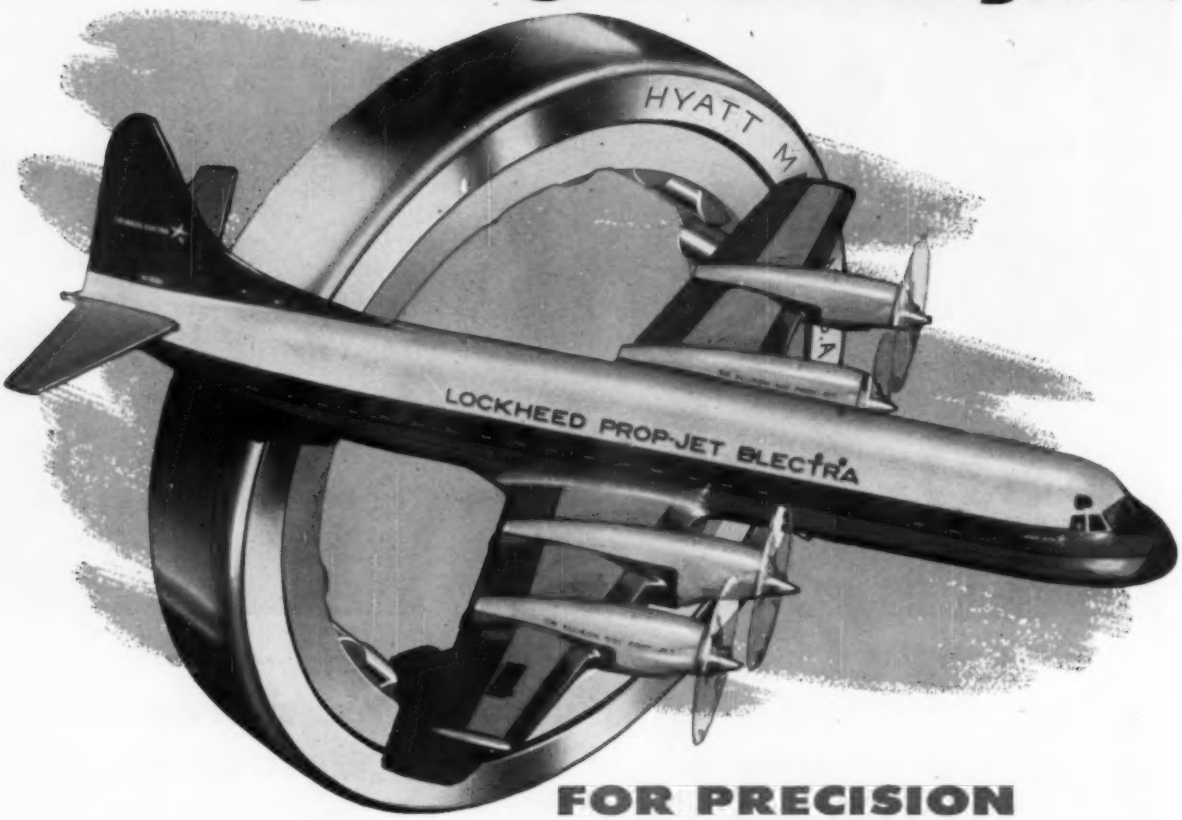

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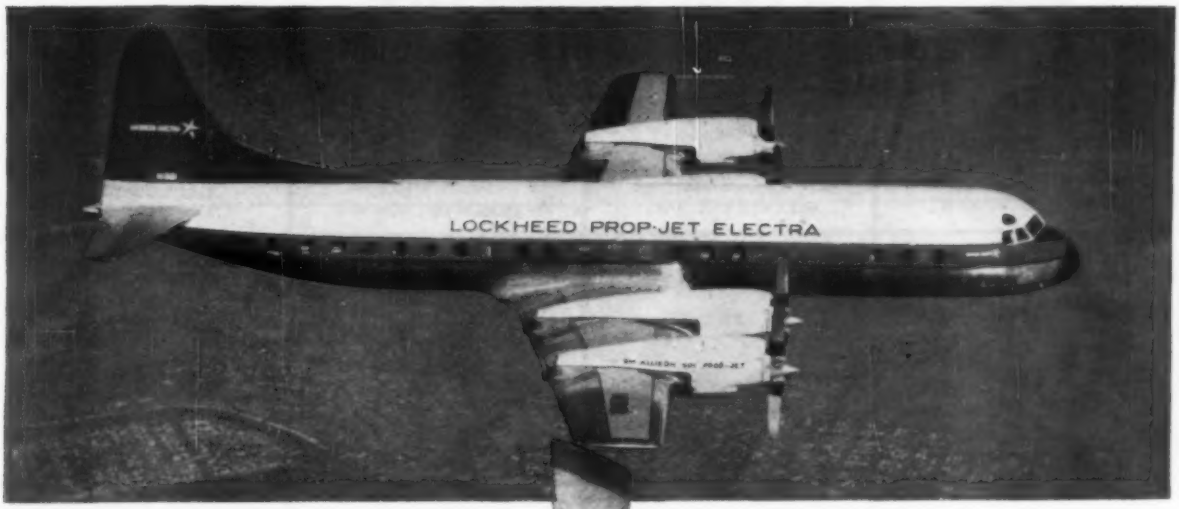

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February 17, 1958

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Vol. 68, No. 7

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COVER: New Sperry Rotorace technique, which uses novel bearing whose outer races can be rotated, periodically reversed, provides 1,000% or more improvement in gyro accuracy by eliminating major source of random drift in non-floated gyros. Photo is montage of gyro (upper left) and new bearings. For details, see p. 78.

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FLY WEATHER-WISE

These weather items prepared in consultation with the United States Weather Bureau

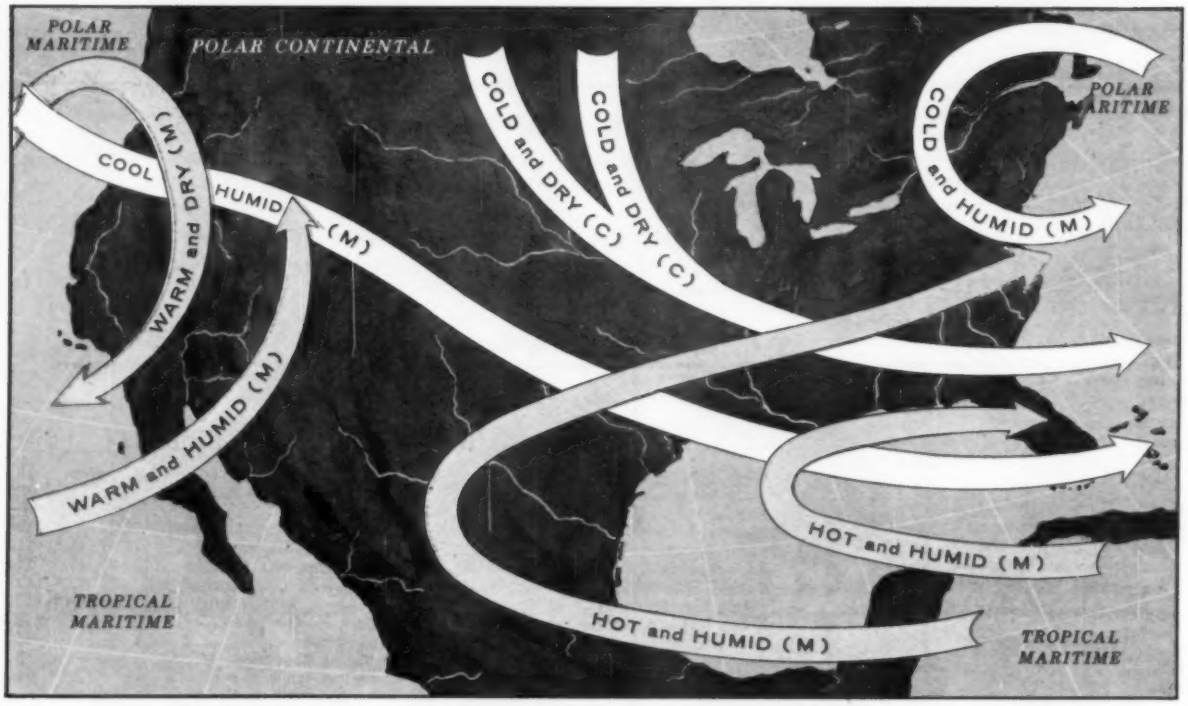

Chart shows typical paths and initial condition of Air Masses entering United States

AIR MASSES

Diagram above shows the major air masses moving into the United States. Broadly speaking, they fall into two categories: Polar and Tropical. Each has certain weather characteristics associated with it.

Polar Air Masses generally move over increasingly warmer surfaces and become unstable, so their weather is characteristically showery. Depending on amount of moisture encountered, they form cumulus-type clouds, rain or snow showers and often bumpy air at low levels.

Tropical Air Masses moving from warm source regions are cooled from below and become stabilized. Stratified clouds like Stratus or Fog are formed. When this moist air meets colder Polar Air, it will ride up over cold front, producing showers and thunderstorms.

Properties of air masses from standpoint of flying during winter season

AIR MASS	CLOUDS	CEILINGS	VISIBILITIES	TURBULENCE	SURFACE TEMPERATURE F.
cP (near source region)	None	Unlimited	Excellent (except near industrial areas, then 1-4 miles).	Smooth except with high wind velocities.	-10 to -60.
*cP (southeast of Great Lakes)	Stratocumulus and cumulus tops 7,000-10,000 feet.	500-1,500 feet, 0 over mountains.	1-5 miles, 0 in snow flurries.	Moderate turbulence up to 10,000 feet.	0 to 20.
*mP (on Pacific coast)	Cumulus tops above 20,000 feet.	1,000-3,000 ft., 0 over mountains.	Good except 0 over mountains and in showers.	Moderate to strong turbulence.	45 to 55.
mP (east of Rockies)	None	Unlimited	Excellent except near industrial areas, then 1-4 miles.	Smooth except in lower levels with high winds.	30 to 40.
mP (east coast)	Stratocumulus and stratus tops, 6,000-8,000 feet.	0-1,000 feet	Fair except 0 in precipitation area.	Rough in lower levels.	30 to 40.
mT (Pacific coast)	Stratus or stratocumulus.	500-1,500 feet	Good	Smooth	55 to 60.
mT (east of Rockies)	Stratus or stratocumulus.	100-1,500 feet	Good	Smooth	60 to 70.

*Source of Polar or Tropical air is indicated by a prefix "C" for continental and "M" for maritime.

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EDITORIAL

Technical Rivalry Is Healthy

Every time the American people come to grips with the genuine problem of reorganizing our national military effort to cope with modern technical and political requirements, there is a great hue and cry over the deleterious effects of inter-service rivalry. We are now in the midst of a vital debate in Congress, the public prints and the executive branch of the government over just what action is needed to effectively modernize our defense structure. The issue of inter-service rivalry is one of the major hinges around which this debate revolves. And it needs some clarification if much light is to be generated from the intense heat of this debate.

There are really two types of inter-service rivalry, and it is important to distinguish between them in evaluating any proposals for defense reorganization. One is the struggle between the leaders of the Army, Navy and Air Force for positions of power and top command in relation to their service rivals and the drive to obtain and retain for their particular service the choice military roles regardless of the major changes wrought by technology and international politics. It is this type of inter-service rivalry that does the real harm. It is needlessly expensive because it virtually equips all three services to fight all phases of any future wars by themselves.

Prevents Effective Defense

It prevents the country from gaining a really effective defense for the money invested because the top-level military horse-trading allows each of the services to retain many of their unnecessary functions and prerogatives in return for similar concessions to the rivals. And it prevents the organization of a really effective national strategic doctrine and top-level command function. This type of inter-service rivalry should be subjected to the closest scrutiny and get major attention in the reorganization effort.

The second type of inter-service rivalry, often lumped with the first in a single package, is competition on the technical level in developing new weapon systems and new weapon concepts. This rivalry is an extremely healthy aspect of our current military picture and should be treated very gingerly, particularly in any effort to centralize and place all technical development under a single decision-making group or individual. Both industrial and military technical history are full of examples where strong research and development rivalry has produced payoffs that would otherwise never have materialized. Also this technical rivalry has often prevented the military from falling into the vacuum created by a bad technical decision by one service because there was a successful alternative developed by another. The history of failure to keep pace with technical progress in both industry and military is characterized by policy decisions for centralization and elimination of competitive developments. Even today in the Soviet Union, certainly one of the most centralized political organizations in history, there is a determined effort to maintain lively technical competition, with great rewards for successful development and corresponding penalties for failure.

The most recent example of where healthy technical rivalry paid off in achievement is, of course, the success of the Army's Explorer satellite in contrast to the technical problems still besetting the Navy's Vanguard project. The decision to bar the Army from this technical competition several years ago was just as basically unsound as the current decision to develop only a single anti-missile defense system. The technical rivalry between the Army and USAF in developing an intermediate range ballistic missile again stimulated faster progress toward operationally useful results than if a single service had been able to dawdle along on its project, secure in the knowledge that it had no competition closer than the Soviet Union.

Propulsion Examples

The propulsion field has been studded with examples where inter-service rivalry saved the country from major military disasters. In the era just before World War II, the Army Air Corps became fascinated with the streamlining possibility offered by liquid cooled engines and made a policy decision to abandon all air-cooled engine development. The Navy took a different view and pushed the air-cooled engine strongly so that when the crisis of World War II arrived the Army would have been in real trouble without the Navy-sponsored air-cooled engines to power so many of its fighters and bombers. Similarly, in post-war propulsion history the Air Force has taken a consistently dim development view of the turboprop while the Navy has been equally consistent in its support of this type powerplant as an admirable "workhorse of the jet age." The fact that both Air Force and commercial transports are flying on extremely useful turboprop engines today is a concrete result of the Navy's technical policy and a dividend of inter-service technical rivalry.

One Danger

The only genuine danger resulting from inter-service technical rivalry is that patently unpromising developments tend to be pushed long past the point when any promise of payoff in useful weapons has passed, merely for the purposes of military politics. Also, if this technical rivalry is continued past the development phase into production of two essentially duplicating weapon systems, such as the IRBM's Thor and Jupiter, it becomes a luxury the taxpayer can neither afford nor really needs.

In the great debate on defense reorganization let's be careful to distinguish between political and technical inter-service rivalry and avoid measures that would eliminate or stifle the strongest type of competition on the technical development level. Without healthy technical competition between both industry and the military services, we cannot make progress at the rate required to stay ahead of our international competitors.

—Robert Hotz

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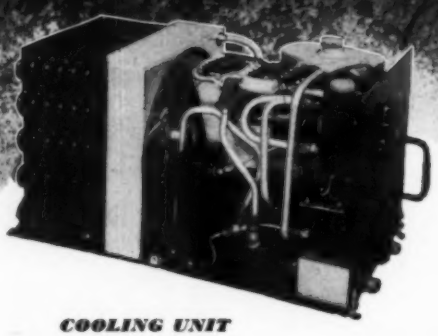
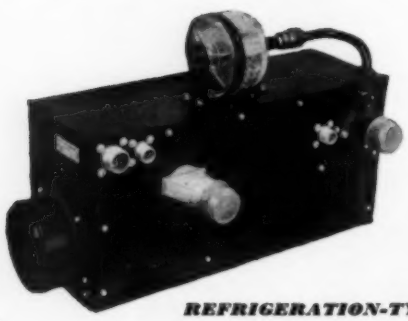


COOLING UNIT



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A. R. Teasdale, director of advanced technology, Temco Aircraft Corp.

Richard D. Eccles, vice-president and general manager of Stockton Helicopters, has been elected president of the Helicopter Assn. of America.

George W. Brooks, vice president and general manager, Greer Hydraulics Engineering, Inc., North Hollywood, Calif., subsidiary of Greer Hydraulics Inc., Jamaica, N. Y.

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J. A. Morley, president of Avro Aircraft Services Ltd., subsidiary in Europe of Avro Aircraft Ltd.

Honors and Elections

William P. Lear, Sr., has been elected to the board of directors of Pacific Airmotive Corp.

W. Laurence LePage, aeronautical engineer and management consultant, has been elected president of the Franklin Institute, Philadelphia, Pa.

Republic Aviation Corp. has been awarded a Certificate of Corporate Membership by the American Astronautical Society.

Prof. Sverre Pettersen, Norwegian meteorologist, has been elected 1958-59 president of the American Meteorological Society, Boston, Mass., and **Henry T. Harrison**, director of meteorology for United Airlines in Denver, Colo., has been elected vice president.

Richard D. Eccles, vice president and general manager of Stockton Helicopters, has been elected president of the Helicopter Association of America.

Edward Adams, Jr., vice president of the National Bank of Detroit, a director, Aeroquip Corp., Jackson, Mich.

A. H. Hobelmann, assistant vice president of the Aviation Division of Walter Kidde & Company, Inc., has been awarded a Certificate of Appreciation by the Society of Automotive Engineers for his work in establishing standards for portable fire extinguishers and development of aircraft pneumatic equipment.

Changes

Dr. Everett T. Welmers, assistant to the president of Bell Aircraft Corp. for long-range planning.

N. M. Graham, manager of commercial sales at the Columbus Division of North American Aviation, Inc.

J. M. Duarte, assistant to the agency and interline sales manager of Braniff Airways.

(Continued on p. 111)

INDUSTRY OBSERVER

► Convair is proposing a Mach 6 ramjet weapon system that would weigh 12,000 lb., be carried approximately 1,000 mi. toward a target by the B-58, be released to travel up to 3,000 mi. to target. Aircraft could then return 4,000 mi. to its home base. It would carry approximately 1,000 lb. payload, fly above 100,000 ft. Convair Fort Worth Division originated the proposal.

► North American WS-110A chemical bomber is scheduled to fly for the first time in 1962, become operational in 1963. Flight test program will be highly accelerated to meet the operational target date. Indication of importance Air Force has placed on WS-110A project is that competition decision was delayed only eight days after the date originally set despite the exceedingly difficult choice between the designs of North American and Boeing and the equipment and process ramifications which required re-evaluation.

► Nuclear warhead version of Hughes Falcon air-to-air missile is scheduled to be flight tested in the near future.

► Polaris fleet ballistic missile is a two-stage solid propellant missile, with optimum specifications calling for an overall diameter of 54 in., length of 28 ft. and 29,000 lb. gross weight.

► Vertol's experimental tilt-wing convertiplane Model 76 has flown vertically and horizontally but has not yet made a transition flight. Test program has been delayed somewhat while components used in the two ducted-fan tail units used for pitch and yaw control in vertical flight are strengthened. First transition flights are expected to be made this spring.

► Turbojet manufacturers have development plans for engines to fit supersonic transports which might be flying by 1970 with speeds in the 1,000 to 1,500 mph. regime. Scale version of General Electric's X-279 engine for WS-110A chemical bomber probably will be groomed to fit this role.

► Vertol 107, a company-financed turbine helicopter, is scheduled to roll out next month. Powered by two Lycoming T53 turbine engines, the project preserves the tandem rotor configuration of earlier Vertol models. It has a smaller fuselage but a roomier cabin than the H-21.

► Ramo-Wooldridge Corp. is providing electronic countermeasures equipment used in two Air Force electronic countermeasures missiles—McDonnell Aircraft's Green Quail (GAM-72) designed to decoy attacking interceptors and missiles away from our bombers, and Fairchild Aircraft's Bull Goose (SM-73) designed for surface launch, possibly against attacking bombers.

► Goodyear Aircraft Corp. is working on means of making its ATRAN—Automatic Terrain Recognition and Navigation System—follow a map with the same accuracy as a human pilot to direct a cruise missile to enemy targets. Formerly, ATRAN required an electronic "map," such as a tape of film "recording" of the terrain to be overflown which had previously been recorded from a radar set carried by reconnaissance aircraft. In operation, ATRAN continuously compares recorded map with terrain and automatically corrects for any deviations from desired track.

► Republic Aviation's new helicopter division is actively demonstrating two French-built Sud Alouette 2 jet-powered helicopters to prospective civilian customers. One aircraft is in the northeast, the other in the west. Republic is busy training additional Alouette demonstrator pilots, including some without previous rotary wing experience, to expand its demonstration program. Current schedule calls for Republic to receive another five to 10 Alouettes via air shipment by the end of the month.

► Fairey Aviation expects a British European Airways contract this year for at least two of its Rotodyne VTOL transports. Production model Rotodyne is scheduled to fly later this year.

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Washington Roundup

Presidential Optimism

Increased defense spending was cited by President Eisenhower last week as one of several government programs and policies that will foster recovery of the U. S. economy later this year.

Eisenhower spoke of "a sharp increase in the first half of this year in the rate at which defense procurement contracts will be placed with private industry." He made no mention of the sharp cutback in the rate at which procurement contracts were placed in the last half of 1957 under Administration spending ceilings.

His expression of faith came one day after his Commerce and Labor secretaries announced that unemployment stood at 4,494,000 in mid-January—the highest since 1950. Aircraft industry employment has dropped more than 100,000 from a peak of 910,000 last April.

Eisenhower also cited as one of the economy's "strong and undiminished underlying forces of growth" the "billions of dollars being spent every year on research and development that will mean new products and new jobs."

Offer to French

France's threat to denounce the bilateral air agreement with the U. S. may have been softened last week by a State Department note offering Air France a route from Paris to the West Coast without asking for additional traffic rights for U. S. carriers in return. The note asked only that France relinquish her traffic rights to Houston in exchange for the West Coast route—a decided step-down from an earlier U. S. stand that stipulated a number of new traffic rights for U. S. airlines.

Possibility that France will accept the latest offer as an interim solution to the problem now appears strong. Some observers suspect that France is not too eager to a complete rewriting of the bilateral agreement for fear of being forced into bringing a number of private French airlines into any revised route pattern. Any agreement calling for full reciprocity of routes and equality of opportunity, as France claims it wants, would reduce direct gains to Air France if other French carriers were included.

Capital Gains

Outlook is favorable for passage of legislation permitting subsidized airlines to set aside earnings from equipment sales for the purchase of new equipment when it comes up for Senate action this week. There will be opposition, however, led by Sen. John Williams (R.-Del.) and Sen. Frank Lausche (D.-Ohio). The measure already has passed the House.

Atomic Committee

Joint Congressional Atomic Energy Committee plans to remain active in outer space matters despite the appointment of a special Senate subcommittee on outer space (see page 28). "Nuclear propulsion is the most important aspect of the outer space field at this time," Rep. Carl Durham (D.-N. C.), chairman of the Atomic Committee, declared. "It is generally agreed that nuclear propulsion will be required to get to outer space, and getting up there is the most important point at this time." Durham reported that progress on all three of Atomic Energy Commission's nuclear power projects aimed at outer space is encouraging: Rover nuclear rocket project; Pluto nuclear ramjet project, and SNAP (Secondary Nuclear Auxiliary Power) project. Durham has no plans to abolish the outer space subcommittee that was appointed promptly after the convening of Congress. But the two subcommittees which probably will be most active on outer space propulsion are the Research and Development Subcommittee headed by Rep. Mel Price (D.-Ill.) and the Military Applications Subcommittee headed by Sen. Henry Jackson (D.-Wash.)

Space Lawyers

Rep. Kenneth B. Keating (R.-N. Y.) says exploration of outer space is going to present as many serious and complex problems to lawyers as to scientists and engineers and that space-age challenges to the legal profession are not far off.

Keating said that, while law must reflect past experience and while legal solutions cannot normally precede practical needs, the space age presents a different picture. Lawyers, he said, will have to anticipate and confront space-age problems before they become additional elements of world tension. "If we wait until the collisions occur before we devise the rules of the road, there may be no hope for the settlement of the clashes by a rule of law."

Keating raises these questions as examples:

- **"Are international rules of discovery** and occupation suitable for determining the rights of nations to terrestrial bodies on which landings may be made?"
- **Who owns space?** "Suppose we were to attempt to apply the principles of established international law by extending the boundaries of each nation into outer space. Because of the curved face of the Earth, the extension would give us an inverted cone which would grow bigger and bigger in relation to the country as it reached farther into space. At some point these cones would overlap and more than one state would be occupying the same air space. Moreover, the continuous movement of the Earth on its axis means that the relationship of particular areas on the surface of the Earth to space beyond the atmosphere would be constantly changing.
- **"What would be the launching nation's liability** for damages if Sputnik II were to come crashing down and destroy valuable property?"

French, Dutch Missile Tour

Group of French and Dutch government-industry representatives have just completed month-long tour of U. S. missile manufacturers and bases to familiarize them with weapons in or nearing operational status. In air-defense missiles, French appear to favor missiles with self-contained guidance, like Boeing Bomarc, which they believe are less vulnerable to mass-raid saturation than ground-directed missiles like the Nike and Talos.

Small Business

Senate Small Business Committee this year plans to focus on these areas as they affect small firms—subcontracting, the weapon system, the missile program, policies on government-owned production equipment, procedures of Civil Aeronautics Board and other regulatory agencies, programs for a pooling of small business facilities on government contracts. The group is headed by Sen. John Sparkman (D.-Ala.). —Washington staff

Industry Girds for Tough Contract Talks

Sikorsky strike vote may portend rugged negotiation sessions; labor, management seem in stubborn mood.

Strike vote and last ditch negotiations last week at Sikorsky Division of United Aircraft Corp. may be a bellwether of a rough and tumble spring this year for the aircraft industry and its labor unions.

Management, with cutback, stretchout and layoff scars, from last year appears to be in no mood for easy compromise. Unions, on the other hand, are not responding with any noticeable meekness to the same circumstances.

If anything, the unions may be rumbling a little louder than usual. Significant signs are co-operation, at least in some areas, by the United Auto Workers and the International Assn. of Machinists, which laid out similar aims in the aircraft industry at national conventions last year. What may be in the wind is a push by the unions for industry-wide bargaining.

Some sources expect a bitter spring. Others think the negotiations will produce sound and fury but little real action. The Sikorsky situation thus becomes a good barometer on how far management and unions are prepared to go—or not to go.

Strike Vote

At Sikorsky, the UAW voted to strike at midnight last Saturday unless a settlement was reached at two meetings prior to the strike deadline. Final strike vote needed only a bare majority for ratification, compared with the two-thirds vote needed for initial strike authorization.

Observers on the Sikorsky scene say the union drive does not appear to be economic. They point out also that economic conditions in the Bridgeport, Conn., area are the worst in many years and are a poor backdrop for a strong union wage push.

Company offered a general across-the-board wage hike ranging from a minimum of nine cents per hour to a top of 14 cents per hour, for a top hourly wage rate of $3.31 for grade 1 employes. The raise was to be effective in December, not at contract expiration.

Union Demands

Union demands at Sikorsky follow what is generally believed to be a national pattern, including compulsory arbitration, a union shop and broadening of the apprentice program, part of a total of 68 demands.

In an exception to IAM-UAW joint moves elsewhere, the IAM last December, settled with Pratt & Whitney Aircraft Division of United Aircraft Corp. on same terms offered to Sikorsky. Exception was P&W's North Haven plant. Contract there is held by UAW and expires in April.

Aviation Week survey of industry's labor front shows, in general, that the two large unions have apparently joined forces to align contracts on an industry-wide basis, dealing with larger companies first. They are:

- **North American Aviation, Inc.**, Los Angeles, Calif.
- **Lockheed Aircraft Corp.**, Burbank, Calif.
- **Chance Vought Aircraft, Inc.**, Dallas, Tex.
- **Convair Division** of General Dynamics Corp., San Diego, Calif.

Contracts at North American, Lockheed and Chance Vought have been shuffled so all expire early in March, and Convair's contract ends April 15. In all cases, it looks as if unions and management are preparing for a long, hard go-around at the bargaining tables with neither side showing much inclination for concessions.

Basic points unions seek are the following:

- **Stiffer severance pay** and relocation cost clauses, apparently as a result of heavy layoffs in the industry.
- **Adoption of escalator clauses** tied to cost of living index, with current 13 cent upward adjustment added to a raise in the present hourly rate (figure mentioned most is 6% across the board).
- **Cut in contract lengths** from the present two-year term to one year.
- **Considerable expansion** of shop apprentice programs.

On the other hand, management teams are preparing for a strenuous bargaining fight, stress recent contract cutbacks and cancellations and blotting up of airline credit by existing new equipment orders.

Top spokesmen contend present economic situation nationally and within industry "leaves little room for labor concessions."

Points for Negotiation

Escalator clause and the hike in hourly wage rates probably will take precedence in upcoming negotiations. IAM already has escalator clause at Lockheed and Convair San Diego plants, and UAW previously gained this at North American.

Thinking right now is the companies will strongly resist adding 13 cent cost of living adjustment to any wage hike. Sources contend part of the adjustment will go into the base rate, but the big question is how much.

Dip in industry employment has the two unions pushing hard for company payment of severance and costs of relocating employes, a clause which includes a per diem settlement. Union wants payment of household shipping costs, en route expenses including eight cents a mile for up to two cars, and relocation pay ($10 a day for worker and spouse, and $5 a day for each minor dependent) up to 31 days.

If employe chooses to turn down his relocation assignment, union wants payment of full severance pay of one-half day's pay for every month of service.

Four-day, 35-hr. week probably will come up for discussion but indications are unions will not push it hard. Profit sharing, proposed at UAW national

Plato Components Test

Washington—Successful tests of unspecified "key components" of the Plato anti-missile system were announced last week by Army. Army also named Plato subcontractors.

Plato was identified by Aviation Week last Dec. 6 (p. 26) as an Army-Sylvania Electric Products, Inc., project aimed at a relatively mobile intermediate range ballistic missile defense system for overseas U. S. bases.

Work is centered in Sylvania's Missile Systems Laboratory of the Electronic Systems Division at Waltham, Mass. Technical supervisor is Redstone Arsenal and contract supervisor is Boston Ordnance District. Subcontractors include General Electric Co., American Machine and Foundry Co. and Sanders Associates, Inc.

Plato system, scheduled to be cancelled in the pre-Sputnik era, will use the Nike Zeus missile now under development.

Air Force last week also identified Sylvania as another subcontractor to Radio Corp. of America for the ballistic missile early warning system (AW Jan. 27, p. 26), and said the Ballistic Missile Division of Air Research and Development Command will manage the overall program. The early warning system will use the Distant Early Warning line and other existing communications and will operate in conjunction with SAGE.

convention, is not expected to be a big issue.

Indentured apprentice programs will get a hard going-over. Union is proposing a plan it says will develop top skills within the industry. Plan centers on employes between ages of 18 and 27 and calls for on-the-job training plan, plus four hours a week of class training to be financed by the company.

A first year apprentice would get 65% of the journeyman rate, rising to 92% in his fourth year, on the basis of present demands. Unions are also pressing for job classification provisions, insisting that employe who is downgraded be returned to his pre-promotion job classification, retaining his seniority. Union also wants same pay for same job, regardless of company worked for.

Labor negotiators again will hammer away for union shop but this has never become a strike issue in the past. As of now, Southern California aircraft companies have a "maintenance of membership" clause, which stipulates that all employes who join a union must remain in good standing during the life of the contract.

Both unions also will propose upgradings in sick leave, vacation benefits and pension and insurance plans.

Public Relations Factor

From all indications, both sides have eye on public relations aspects of negotiations, in view of current defense and space developments. One spokesman mentioned: "The ghost of the government is at the bargaining table."

While management points to industry cutbacks and stretchouts, the unions contend that increased defense tempo with resultant spending will offset this factor.

Unions are known to be preparing public relations program and possibly could, AVIATION WEEK has learned, ask for early assistance by federal mediators and conciliators. Intense public interest in the missile race may have a bearing here.

At the UAW convention, delegates approved a $5 dues increase during March, April and May, with funds collected going into the UAW strike fund. (Chance Vought local opposed this move and voted against it, but resolution passed by large majority.)

Soviet Astronautical Meeting Planned

Moscow—Soviet science officials say they expect 1,200 scientists from at least 50 nations to attend the International Astronautical Congress scheduled to be held here in August. Last year's meeting of the International Astronautical Congress was held in Barcelona (AW Oct. 14, p. 29).

Defense Warned Missile Tests Jeopardized by Telemetry Lack

By Philip J. Klass

Washington—Defense Department has been warned that success of missile and aircraft flight tests is being jeopardized by lack of coordination and progress in modernizing telemetry equipment standards and in obtaining adequate frequency allocations.

Defense also has been urged to establish a single telemetry agency, consisting of representatives of military services, aircraft missile manufacturers and telemetry equipment makers and with the authority to correct the present situation.

Warning and recommendations come from L. W. Gardenhire and G. M. Thynell, past and present chairmen of the National Telemetering Conference, a national group that represents the Institute of the Aeronautical Sciences, American Rocket Society, American Institute of Electrical Engineers and the Instrument Society of America in the field of telemetry. Gardenhire is an engineer with Radiation Inc., a telemetry manufacturer. Thynell is with the Johns Hopkins University Applied Physics Laboratory.

Warning is of particular interest in view of unconfirmed report that recent unsuccessful flight of Atlas missile may have been caused by the pick-up of a stray radio signal from another telemetry transmitter.

James Spriggs, member of the staff of William M. Holaday, Defense Department director of guided missiles, met recently with Gardenhire and Thynell.

Spriggs, former chairman of the Research Development Board instrumentation group which established the present telemetry standards nearly 10 years ago, suggested that the National Telemetry Conference should be an advisory group that would make specific recommendations. However, he could give no assurance that Defense would be able to act upon these recommendations, AVIATION WEEK was told.

Divided responsibility, which makes it difficult for Defense Department to act, is one of the primary roadblocks preventing adoption of improved telemetry techniques, such as new pulse modulation, Gardenhire says.

Telemetry manufacturers are reluctant to put new techniques into production without assurance of a potential market. Aircraft/missile manufacturers will not buy new airborne telemetry equipment without assurance that the military test ranges will be equipped with the required ground-based equipment. Military ranges, hard put to find funds for instrumentation, will not commit themselves to new ground equipment purchases until they see that new incoming aircraft/missile will require such facilities, Gardenhire says.

Result is that each group waits for the other to act, powerless by itself to set the wheels in motion. This, Gardenhire says, is why the telemetry equipment in use today is far less effective and far more extravagant in use of radio spectrum than the equipment which telemetry makers could produce.

Military services have established an informal organization known as The Inter-Range Instrumentation Group, which seeks to standardize telemetry facilities among the various test ranges.

Assigned telemetry band of 215 to 235 mc. has long been recognized as inadequate, yet half of it is being taken away for use in other military applications. Even with the original spectrum assignment, channels are in such demand that missile telemetry equipments can not be fully checked out prior to launching, Gardenhire says. In pre flight checkouts, it has been necessary to use "dummy loads" for checking the output of telemetry transmitters. Signal is not actually radiated but is transmitted by coaxial cables. This not only greatly complicates and delays the task of missile check-out but fails to provide complete assurance that equipment is operable.

Frequency band in the 2,200 mc. region also has been assigned for telemetry. However, at these microwave frequencies, new techniques must be employed which increase size, weight and cost of airborne equipment.

Another function of the Defense Department group which the National Telemetry Conference proposes would be to study and recommend minimum spectrum needs for future systems.

Spriggs told AVIATION WEEK he believes the problem is not as bad as Gardenhire suggests, although he admits that the situation is far from ideal. Spriggs points out that Aeronautics Inc., under Army Signal Corps contract, has been studying the whole telemetry problem for the past year. Following completion of the study during the coming year, the long-used RDB telemetry standards may be revised to provide for new pulse modulation technique standards.

Although Spriggs concedes the importance of telemetry, he says Defense is not now in a position to establish the agency which the National Telemetry Conference chairmen have suggested.

Senate, House Form Space Units; USAF Space Claim Recognized

By Ford Eastman

Washington—Both the House and Senate moved in separate actions last week to create new committees to shape national space policy and monitor U. S. activity in space exploration.

Earlier, Defense Secretary Neil H. McElroy ordered establishment of the Advanced Research Projects Agency and tentatively placed responsibility for operation of manned space vehicles with the Air Force. These were the developments:

- **Vice President Richard Nixon,** acting upon recommendations of Senate Majority Leader Lyndon Johnson (D.-Tex.) and Minority Leader William Knowland (R.-Calif.), named a 13-man special committee to study space problems and to recommend a national space policy.
- **Rep. Kenneth B. Keating** (R.-N. Y.) introduced a resolution to create a standing House committee to deal with space problems on a permanent basis.
- **Secretary McElroy** issued a directive creating the Advanced Research Projects Agency and named Roy W. Johnson, General Electric Co. vice president, as its director.

ARPA's Functions

ARPA's function will be to proceed with research and development of weapon systems and military requirements for an indefinite period, and space projects authorized by the President for one year. By that time, it is expected that Congress will have studied and acted on legislation to place firm responsibility for space programs in either an existing or a new agency.

Named to the special Senate committee established for this purpose were Democratic Senators Johnson, Richard Russell (Ga.), Warren Magnuson (Wash.), Stuart Symington, (Mo.), Theodore Francis Green, (R. I.), John L. McClellan, (Ark.) and Clinton P. Anderson, (N. M.). Republican senators are Styles Bridges (N. H.), Alexander Wiley (Wis.), Leverett Saltonstall (Mass.), John Bricker (Ohio), Bourke Hickenlooper (Iowa) and Karl E. Mundt, (S. D.).

Formation of a staff and of an outline for a planned course of action are expected to begin this week.

Keating, in introducing his resolution to create a standing House Committee on Outer Space, warned that to delay action would invite confusion and jurisdictional problems.

He said he introduced a bill to establish a joint congressional committee on the first day of the session, but that no action had been taken on the proposal. Meanwhile, the Senate went ahead on its own.

Keating proposed amending the Rules of the House to create the committee and authorize it to make continuing studies of the use and control of outer space, with particular attention to:

- "**Research, development, production** and other activities of any department or agency of the government, or of any private agency, conducting activities relating to outer space, including such activities relating to rockets, missiles and Earth satellites.
- "**International relations** and agreements concerning legal, jurisdictional, communications, navigation and other matters concerning the use and control of outer space.
- "**Security standards and safeguards** with respect to outer space activities.
- "**Control and dissemination** of information concerning outer space activities.
- "**Protection of health** and promotion of safety in connection with research, development and production activities relating to outer space."

Keating told the House that no single committee is now constituted to deal comprehensively and in a coordinated fashion with these measures. In many instances, he said, a single bill concerned with space cuts across the lines of interest of a number of standing committees. With many bills already introduced, he added, the result is that a number of committees may want to duplicate hearings on a single issue or a series of issues.

ARPA and Congress

If approved, the House committee, like the Senate, will undoubtedly consider the role ARPA will play in the exploration of space. Congress authorized the Defense Department to proceed with urgent weapon systems and military obligations in its 1958 supplemental appropriations bill, but placed a one-year limit on non-military space projects.

In announcing formation of the agency, McElroy said that, at this stage, he did not think that certain projects such as surveillance fit into strictly military or non-military categories. He said the so-called scientific information being received from present satellites is providing basic information needed for any further satellite planning—scientific, non-military and military.

In regard to projects already under way, McElroy said he felt ARPA should provide direction and financing but not interfere with the actual operation. This he said would, in effect, make the services already engaged in research agents of ARPA, which would do the planning. Other opinions expressed by McElroy:

- **There is no reason** why the Defense Department cannot work very well with a civilian agency if one is picked to control space projects. "We have done so in the case of the National Advisory Committee for Aeronautics on aircraft development, and very successfully. We have been very happy with what has been achieved by that joint endeavor, and I believe that the NACA has also felt that it has been very satisfactory from their standpoint. I would say there would be a complete concurrence on our part with the desirability of working with an agency like the NACA . . . and I think we have contributed to each other's programs in a way which I think is most desirable for this kind of thing to proceed."
- **William M. Holaday** will retain his full responsibility as director of guided missiles under ARPA, while the new director will assume control of the anti-missile missile, satellite and other outer space programs.
- **There is no thought** of dropping Vanguard project as a result of the two failures in attempts to put a small satellite into orbit.
- **First intercontinental** ballistic missile unit probably will be operational by the end of 1959.

Career of ARPA Head At GE Detailed

Washington—Career of Roy W. Johnson, General Electric vice president named to direct the Advanced Research Projects Agency has been devoted largely to the fields of advertising and GE's household appliances operation.

After graduating from the University of Michigan in 1927 with an A. B. degree, Johnson joined the advertising firm of Campbell-Ewald. In 1930, he joined the advertising staff of General Electric's Appliance Department, moved up to become manager of the Home Laundry Division, later became manager of Pioneering Products (new types of appliances).

In 1939, when Ralph J. Cordiner, now president of GE, left General Electric's Appliance Department to become head of Schick Inc., Johnson followed and joined Schick's sales department.

In 1942, he followed Cordiner to the War Production Board where he became director of Facilities Bureau. When Cordiner left WPB in 1944 to return to GE's Appliance Department, Johnson re-joined the firm as vice

ROY W. JOHNSON

president of commercial activities for the company's Telechron (electric clock) subsidiary.

In 1948, Johnson became vice president in charge of affiliated manufacturing companies, which included Telechron, Hotpoint, Trumble, Monowatt and other subsidiary firms making electrical hardware and supplies.

In December, 1950, Cordiner succeeded Charles E. Wilson as president of General Electric when the latter came to Washington to assume a government post during the Korean war. Two months later, the company underwent a major reorganization, and Johnson was named executive vice president in charge of appliance and electronic activities.

At that time, GE's consumer electronics (TV, radio) were part of the same division which developed radar and other military equipment. In November, 1955, General Electric separated these two portions of its electronics business, pulling the defense portion out of Johnson's group and placing it in the Electronic, Atomic and Defense Systems group under another executive.

This four-and-a-half year span, in which Johnson was general manager of all of GE's appliance and electronics activities, is the electronics experience cited by Defense Secretary Neil McElroy as one of Johnson's qualifications for his new job.

During this same period, GE's Electronics Division was headed by Dr. Walter R. G. Baker, who held the title of vice president prior to the reorganization. Baker ran his division with a firm hand and with few requests for outside assistance.

However, a GE official who was employed at the company's electronics research laboratory says Johnson always took a personal interest in the activities of the laboratory whenever he visited Syracuse, N. Y.

In October, 1957, Johnson was relieved of his command as vice president of the appliance group and named a "consultant" to his successor. No reason was given for the action, although it may have stemmed from GE's lagging appliance sales.

Johnson, who is 52, has what he calls "substantial" holdings of General Electric stock, probably in the range of several hundred thousand dollars. Because the ARPA position does not require congressional approval, any conflict of interest issue may not be raised officially.

One of Johnson's former associates in GE's appliance department says his experience well qualifies him to quash inter-group rivalries. Another former GE associate says he can be tough and ruthless.

Johnson, who is expected to receive $18,000 or $19,000 a year in his new post, received a salary of $158,000 in 1956 from General Electric. Johnson is quoted as saying that he plans to remain at ARPA for only about two years and does not plan to return to GE afterward.

Nuclear Rocket May Be Accelerated

Washington—Atomic Energy Commission is expected to ask Congress within the near future for a substantial increase in funds to accelerate its nuclear rocket program.

Two key AEC spokesmen have assured a subcommittee of the Joint Congressional Atomic Energy Committee of the ultimate success in the development of a nuclear-propelled rocket.

AEC Chairman Lewis Strauss reported that there is no skepticism among scientists working on the Rover nuclear rocket project. Col. Jack Armstrong, assistant director of AEC's Aircraft Reactor Branch, testified, "I know they are going to do it." Achievement of the hydrogen bomb was a far more difficult undertaking, both Strauss and Armstrong pointed out.

The request for new funds will be to finance an alternative approach to Rover, rather than to compress the present program's timetable. Sen. Clinton Anderson (D.-N. M.), chairman of the subcommittee, said. Rover is scheduled for initial testing later this year at AEC's Nevada test range.

Armstrong gave these two major advantages of nuclear propulsion over chemical propulsion for outer space:

- **With less weight and greater thrust,** nuclear propulsion can "obviously" support a much larger payload.
- **Nuclear propulsion** will have greater dependability, since it will be possible to fire it into outer space in one shot, while chemical propulsion will have to be fired in stages, involving more parts and more possibilities for failures.

Strauss put ionic propulsion in the far future, commenting that "there will have to be a very great breakthrough."

'Giant' Engine Gains Cited as Space Need

Washington—Among the major steps that must be taken before manned space flight becomes a reality are "giant advances in engine and system reliability" and development of very light engines and structures, a National Advisory Committee for Aeronautics rocket specialist said last week.

John L. Sloop, chief of the Rocket Engine Branch of NACA's Lewis Flight Propulsion Laboratory, told an Institute of Aeronautical Sciences meeting that "it is quite likely that for an ambitious space flight undertaking, several propulsion methods will be used at various steps in the flight."

High energy liquid propellant rockets show promise for Earth satellite and Moon missions and perhaps as far out as Mars, Sloop said. Nuclear rockets also are promising in these areas.

Proposed electric systems—arc-jets, ion-thrust, plasma accelerators and photon sail engines—"are most promising on the interplanetary flight," Sloop said.

Sloop believes a vigorous and imaginative research program will put the U. S. ahead in propulsion methods for satellites and space flight. But he said these steps must be taken before man flies in space:

- **"We must develop high-energy fuels** and very light weight but powerful engines."
- **"We must develop propulsion** systems that use very little propellant for long periods of time such as the electric system."
- **"We must learn how to make** very light structures, for every pound we carry along represents a very high investment in energy."
- **"We must make giant** advances in engine and system reliability for there won't be a spare parts warehouse or filling station if we need more parts or 'gas'."
- **"We must develop very** accurate guidance systems in order to fly along the exact orbit timed carefully with respect to the Moon or planet we wish to reach."
- **"Man must learn to live safely** in the dangers of outer space and keep alert in the confines of his ship for many days of flight."
- **"We must learn how to make vehicles** to bring him safely back into Earth's atmosphere and land."

FLIGHT view of Vertol Model 44 helicopter shows Neoprene-coated nylon bags which are kept inflated at all times. System causes drag.

Permanently-Inflated Float Gear Tested

AT TAKEOFF, water pours from faired "cages" that hold main gear floats, and from fairing around which nose gear nylon bag fits.

CRANE lowers Model 44 in first test.

on Model 44

New York—Permanently-inflated nylon bags are key units in new helicopter emergency flotation system developed by the Vertol Aircraft Corp. for New York Airways, the Swedish Navy and Sabena Belgian World Airlines.

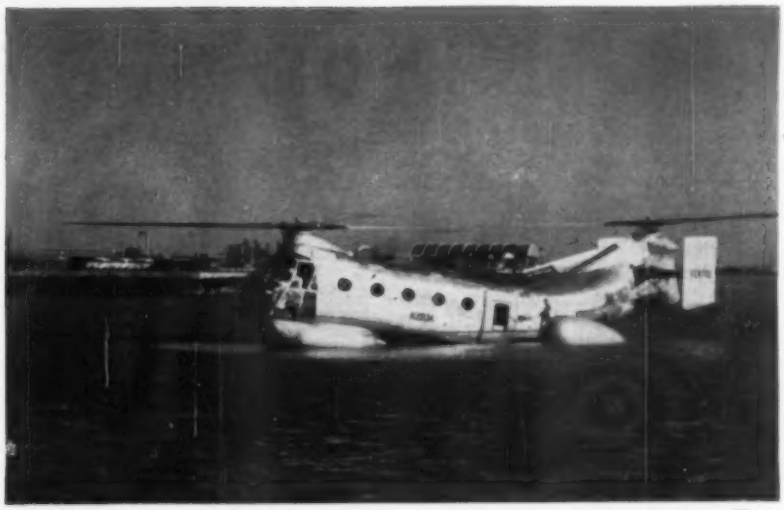
Intended only as a safety measure, system has had 10 hr. of flight testing and will undergo CAA tests next week, according to Vertol officials.

Vertol has combined Model 44 fuselage sealing with inflatable gear to allow amphibian helicopter operations under emergency conditions. Company tests were made at Mustin Field, Philadelphia Navy Yard.

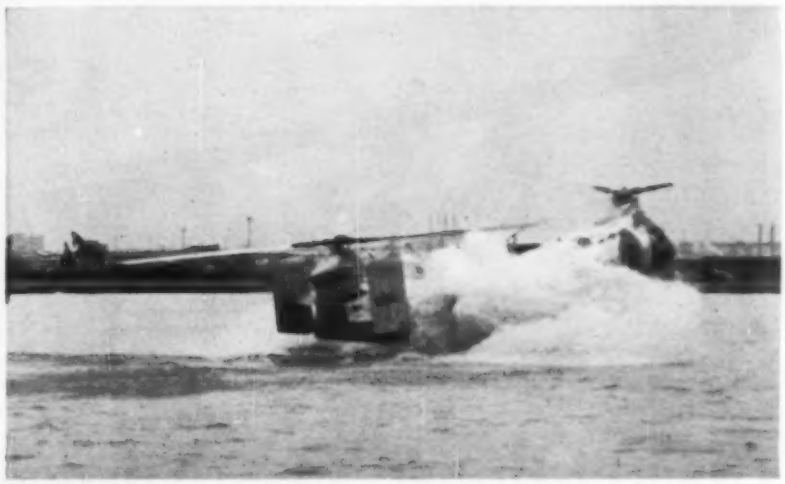
New York Airways has ordered five Model 44s operating into New York's 30th Street heliport, a platform which extends into the Hudson River; the Swedish Navy has purchased four for antisubmarine warfare, and Sabena plans to fit two with floats.

Major advantage, aside from the safety factor, is that aircraft's tandem rotor configuration and long fuselage obviate the need for a shaped boat-like hull, according to the designers.

Floats, made by U. S. Rubber Co., are nylon fabric coated with Neoprene rubber. Main gear floats are teardrop shaped to cut drag. Forward float is



FUSELAGE on test model has been sealed to a level 12 in. above static water line. Floats are compartmented to preserve flotation even if punctured.



MODEL 44 water touchdown shows water streaming past tail section.

MODIFIED helicopter touches on main floats in three-point position at 30 kt.

attached to fuselage by a girt strip which acts as a fairing. Fuselage is sealed to 12 in. above static water line.

Floats are inflated to 1.5 psi, by use of ground inflation valves. Company believes gear will reduce cruising speed by four or five knots. Total weight, including fuselage sealing, is 340 lb. Engineers estimate about 80 lb. of additional gear, such as air bottles and valves, are saved by keeping bags inflated at all times.

Air bags are compartmented so aircraft will float even if bags are punctured in the landing. Vertol said that for regular operation from a water base, additional hull compartmentation, bilge pumps and other provisions would be required.

Before flight testing, company carried out a number of wind tunnel tests on a model at the University of Detroit. At Philadelphia, auto-rotational landings were accomplished and water resonance tests concluded with what company termed satisfactory results.

Flying at 30 kt. at touchdown, at a gross weight of 14,300 lb., Model 44 sends water high into air but pilot reports sensation is much the same as a water landing in a flying boat. Aircraft has been taxied at speeds up to eight knots with no difficulty in handling.

Technique calls for pilot to "fly" helicopter into water. At takeoff, water pours from the faired cages that hold main gear floats and from nose-gear fairing.

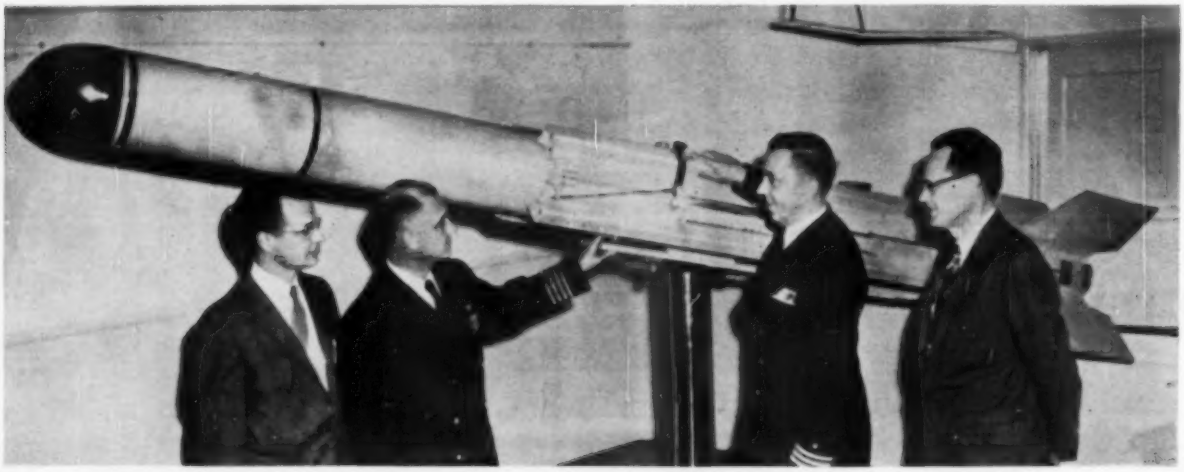
In past test, Vertol has made HUP-2 amphibious by sealing fuselage and adding outrigger floats (AW Oct. 21, p. 32). System called for extensive modification of aircraft.

Sabena will use two Model 44s to expand its helicopter service in Europe during the Brussels World's Fair. Both have been leased from Vertol for six months effective April 17, opening of the Fair. Airline operates helicopters from Brussels to Paris, Rotterdam, Cologne and Bonn.

A. V. J. Vernieuwe, airline's senior vice president, said Sabena will evaluate Model 44 as a permanent addition or as a replacement to its present fleet of single-rotor helicopters.

Sabena personnel will fly the aircraft. One Model 44 will be equipped with a 15-passenger airline interior, and the other with 14 passenger seats and a lavatory.

Vertol will send a pilot, technical representative and crew chiefs to Brussels to supervise training and maintenance. The helicopters are expected to fly about 10 hr. a day.



RAT (rocket-assisted torpedo), Navy anti-submarine weapon, is displayed. Torpedo is acoustic-homing type (AW Feb. 10, p. 97).

Rocket-Boost Navy Torpedo Operational

By Richard Sweeney

Pasadena — Rocket-assisted torpedo (RAT) anti-submarine weapon system developed by Naval Ordnance Test Station, China Lake, which now is operational with fleet units, was unveiled here last week.

Weapon system consists of lightweight homing torpedo, rocket booster and airframe launcher. Fire control system uses analog computer utilizing data derived from ship's normal sonar gear.

Use of RAT enables surface vessels to wage anti-submarine warfare at a distance and without leaving assigned stations in formation, instead of having to leave station, close on enemy sub and try to destroy him with depth charges.

RAT can be incorporated on any surface ship having standard 5-in. anti-aircraft gun mounts, Navy says, with emphasis on the destroyer, which has a prime mission of anti-submarine warfare. Launchers are magazine type, with two launchers mounted in fixed position on each gun turret. Aiming is accomplished by gun mount mechanism in azimuth and elevation.

System operation has sonar gear detecting sub presence, obtaining range and bearing information which is fed to the analog computer. Computer programs missile flight and light goes on to signify missile is ready for launch. Missile is launched, flies to area of target where airframe is separated from torpedo; torpedo is lowered to water by parachute; parachute equipment separates from torpedo on water entry, and torpedo goes on its homing mission.

Missile weighs 450 lb., is 16 ft. long. Torpedo, developed by Clevite Research Corp., is approximately 8 ft. long, 10 in. in diameter. Airframe covers just less than half this length, extends backwards to enclose short burning time, solid propellant rocket motor developed by Allegany Ballistics Laboratory. Airframe is built-up sheet metal, held in place during launch and through required ballistic trajectory by straps which are blown off at proper point in flight. When straps are loosed, airframe peels off from aerodynamic forces, in two pieces.

A timing device, set by the fire control system before missile is launched, detonates straps at any preset point in missile's range capability, which is several miles.

Releasing of airframe initiates parachute sequence, which has missile first slowed down by deceleration parachute to point where main canopy is opened. Size of main canopy was dictated by maximum velocity at which water entry could be made. A special nose cone on torpedo absorbs first water impact

Aircraft Nuclear

forces, prevents damage to torpedo's homing equipment.

Nose cone and parachute system separate from torpedo at water entry.

Since ballistic values are well known, fire control is less sophisticated than many others, is interlocking with missile reduced to setting the timing device which blows off straps after proper flight interval.

Pinpoint accuracy of flight distance is not required since homing equipment requires placing the torpedo just within a certain area rather than at a specific point.

Missile velocity is high subsonic, and the system cannot be jammed in flight. Use of solid rocket motor further enhances reliability and simplicity.

Flexibility is provided in that the airframe can utilize a number of torpedoes, is not limited to one.

Librascope Inc., developed fire control system, and launchers were developed by Puget Sound Naval Shipyard. System took four years from conception to operational status.

Earl D. Prudden Dies; Was Ryan Vice President

Earl D. Prudden, retired vice president of Ryan Aeronautical Co., died on Feb. 6, at the age of 62, in San Diego, Calif. During World War II Mr. Prudden headed Ryan's military pilot training programs at San Diego, and Hemet, Calif. and Tucson, Ariz.

Bill to Alter Obligational System Gets Increased House Opposition

Washington – Proposed legislation that would change the present obligational system of budgeting to an annual accrued expenditure basis is meeting increased opposition in the House. The bill passed the Senate without opposition during the last session.

The bill, now awaiting floor action in the House, has been opposed publicly by individual aircraft manufacturers and the director of Industry Planning Service of the Aircraft Industries Assn.

Introduced in the House by Rep. Paul G. Rogers (D.-Fla.), the bill was designed to eliminate large unexpended carryover balances and improve congressional control of the budget. It is supported by the Citizens Committee for the Hoover Report, and its passage was urged by President Eisenhower in his budget message this year.

At present, estimates for appropriations are presented and funds appropriated to cover the goods and services to be ordered in the budget year regardless of whether the goods or services are to be received or paid for in the budget year or during subsequent years.

At the time the services or goods are ordered, an amount is obligated or reserved in the appropriation account to pay the vendor upon delivery.

Under the new bill, H. R. 8002, funds would be appropriated to pay for goods or services that are expected to be received during the fiscal year, and where needed, authority given to enter into contracts and orders for goods and services to be delivered in future years.

In a signed statement last year, 38 members of the House Appropriations Committee said the proposed bill would tend to confuse the economy issue and increase government spending and make it easier to get Congress to grant authority to obligate the government.

The statement said the proposed bill would merely put the government into installment buying, a practice which in personal operation had led millions of families into over-spending, by substituting contract authority for appropriations.

"In appropriation bills now," the statement said, "we generally fully finance long-range programs for aircraft, ships and other long-lead time items. Congress and the country know in advance just how big and expensive the programs are."

Rep. John Taber (R.-N. Y.) who was one of the signers of the statement, said

T2J-1 Trainer Makes First Flight

Five weeks after rollout at North American Aviation's Columbus, Ohio, Division, new 500-mph. T2J-1 all-purpose Navy jet trainer is shown airborne Feb. 10, during a low-level flyby with gear down. First flight, with airplane still unpainted, was made three days before. Designed for training pilots from primary through advanced phases, including carrier qualification, T2J-1 is powered by a single 3,400-lb.-thrust Westinghouse J34-WE-36 turbojet mounted in the belly. Plane incorporates NAA-Columbus-designed seat ejection system permitting safe escape at ground level. Landing speed is reported at 77 mph., service ceiling as over 40,000 ft. Following initial tests at Columbus, T2J-1 is scheduled to start intensive evaluation program at Palmdale, Calif.

the proposed bill will "utterly destroy all prospects of a tax cut and break down our hopes of balancing the budget." He added that the bill would destroy the power of the Appropriations Committee to keep spending in line.

Rep. Don Magnuson (D.-Wash.) another signer of the statement, said last week that under H. R. 8002 any remaining balances of an appropriation or fund at the end of a fiscal year would lapse. This, he said, could impose a hardship on manufacturers who must submit their estimates of annual delivery rates and costs long in advance. Such estimates, he added, are extremely difficult to determine accurately. Magnuson said passage of the bill could result in increased costs of the overall program and a slower delivery rate.

George Hannaum, AIA director of industry planning service, charged that the bill, if passed, would "hamstring vital defense projects and cause costly delays." He said that, if funds are exhausted before the end of a fiscal year, no provision is made for funding contracts for the remaining days or months —a situation that could not be corrected by a supplemental appropriation by Congress because of the amount of time it would require.

Production of top priority defense projects such as the anti-missile missile could be seriously affected by the bill, Hannaum said. Technological breakthroughs or advances governing its progress and gains or failures to achieve them on a rigid schedule would cause the program to be accelerated or decelerated, he said.

"There is no method of determining a year in advance just what our scientists and engineers will discover in their probings of technological frontiers," he said. "If an unexpected breakthrough is made, funds are not available to exploit this advance simply because they were not requested in the estimate."

The AIA spokesman said it had been conservatively estimated that delays of three to nine months could be incurred in a new fiscal year before funds would again flow to contractors. These gaps, he added, could only be bridged by asking contractors to shoulder financial burdens that they might be unable to carry, or to assume risks they are unable to take.

William M. Allen, Boeing Airplane Co. president, also protested the proposed legislation in a letter to Magnuson. Allen warned the bill could tend to increase overall costs of programs by requiring a contractor to pace his efforts to stay within estimates of expenditures rather than proceed on the most economical total program basis.

In addition, he said, any delay by Congress in appropriating funds for a new year would result in invoices not being paid.

Bell HU-1A Helicopter Ordered in Production

Ft. Worth—Army's new HU-1A turbine-powered helicopter has been ordered into production at the Bell Helicopter Corp. plant here under a contract issued by USAF's Air Materiel Command.

Order for the HU-1A, production version of the XH-40, includes production tooling, spare parts and supporting equipment. Bell now has enough HU-1 orders to carry production through the end of 1959.

The order from AMC, which administers the contract for the Army, follows a series of three orders for 18 test versions of the utility helicopter. First order was for three experimental models. These three XH-40s are now in Phase III flight test.

AMC ordered six YH-40s for service test, and the first machine built under this order flew two weeks ago. Last summer, nine more HU-1s were ordered for field service test. With the new order, Bell will tool for quantity production.

Bell's new utility machine is powered by an 825 shp. Lycoming T53 turbine engine. It has a top speed of about 150 mph., range of more than 200 mi. with full payload and a vertical rate of climb of 2,000 fpm.

Army Orders French Anti-Tank Missile

Paris—Nord Aviation has received a "substantial" order from the U. S. Army for its S.S10 anti-tank wire-guided missile.

The S.S10, used with considerable success by the Israeli army against Egyptian tanks during the Suez campaign, weighs about 33 lb.

It can be launched from a jeep, helicopter or even from its container. Two wires unwind from a launching drum and are used to guide the missile on target. S.S10, called Tankbuster by the French, can be fired around corners.

It is understood the initial U. S. Army order calls for delivery of some one thousand missiles. Of this amount, some will be delivered directly to the U. S. Seventh Army in Germany while the balance of the initial order will be shipped to the U. S. for further operational test programs. S.S10 already has been ordered in quantity by West Germany, Switzerland, Sweden, Israel and others. United States originally ordered a small quantity for test programs.

Average speed of the S.S10 missile is about 200 fps. Rocket uses a solid propellant motor. French estimate the mean kill probability at 80%.

Aircraft Nuclear Propulsion at Marquardt

by
Roy E. Marquardt
President

Aircraft Nuclear Propulsion projects now underway in ASTRO, a Division of Marquardt Aircraft, offer engineers and scientists challenging opportunities in a variety of technical fields. Here, where we are dealing with development problems on high-performance systems with stringent design and reliability requirements, creative engineers and scientists will find real challenge and opportunity for accomplishment.

Project personnel are currently working in such fields as radiation shield design, aerothermodynamics, control system design, instrumentation research, stress analysis, and neutronics. Problems range in scope from preliminary performance analysis through design of test facilities.

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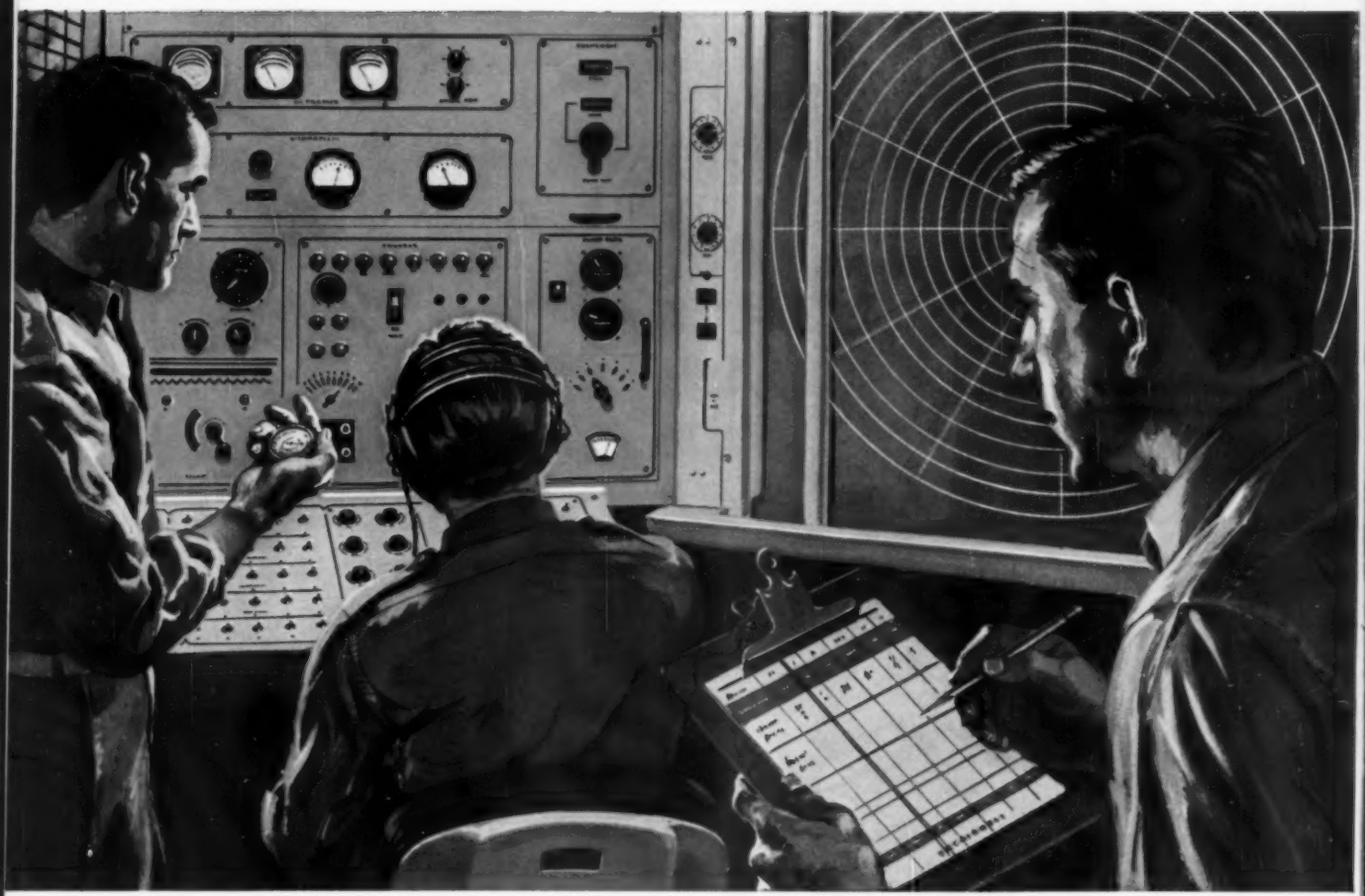

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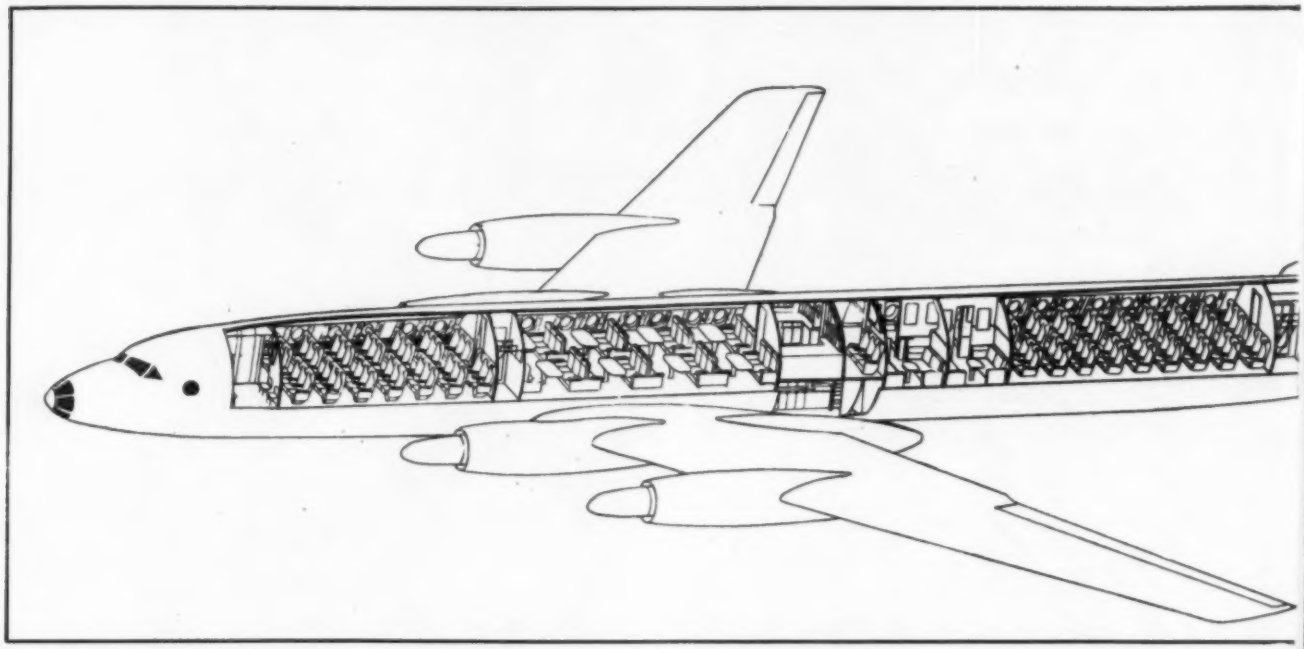
Pan American 707 Nears First Flight

First U. S. jet to bear airline colors recently rolled out of Boeing Airplane Co. plant at Renton, Wash. (above). The Pan American 707 Stratoliner is expected to make its first flight sometime next week. Plane is the second production 707. Below, first production plane takes off from Seattle-Tacoma Airport following first visit to a commercial field. It landed at airport during ILS equipment-testing program.



DOUBLE-DECKED Tu-114 transport is largest in world, can carry up to 220 passengers on short hauls, 120 on intercontinental flights . . .

Soviets May Offer Tu-114 Turboprop to

Soviets may put giant turboprop on world markets; low operating cost stressed over speed, capacity.

Moscow—Advance billing of the Soviet Union's Tu-114 turboprop transport is stressing passenger-mile economy and operational flexibility—a first sign that the Russians may offer the huge transport in world markets.

Speed, high carrying capacity and long-range capabilities are not being overlooked, and the Russians are plumping the Tu-114 as the world's largest passenger-carrying transport with speeds that will compete with the best Russian and foreign turbojets.

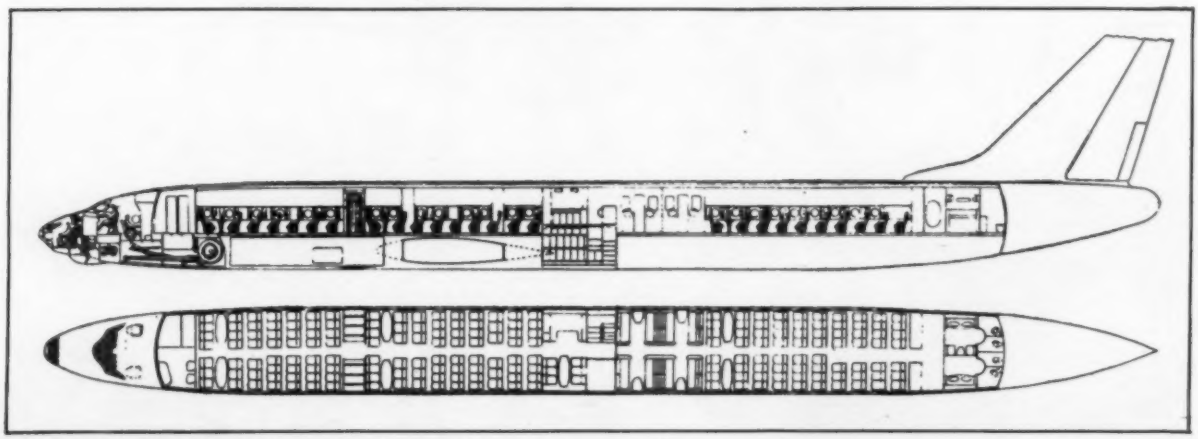
However, a new note of economy has been injected into propaganda themes with an emphasis, rare for the Russians, on the low operating costs of the aircraft. Undoubtedly, the Russians will use the economy angle as a means of "selling" the plane outside of Russia for prestige rather than trade purposes.

Low Fare Level

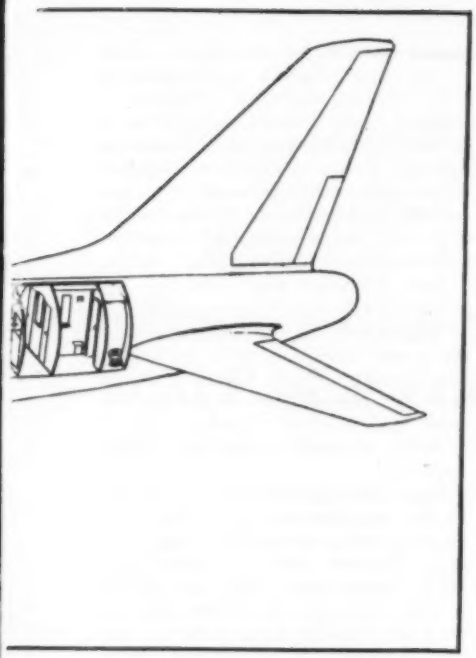
According to Russian sources, designers were directed to hold operating costs of the aircraft at a level that will pull air fares down to a par with first-class rail fares. S. Eger, chief of the Design-Test Bureau of Aeroflot, Soviet-owned airline, says the new Tupolev transport, in its 220 and 170-passenger versions, will be a major threat to railroad dominance of long-haul travel in the U.S.S.R.

Eger says the first Tu-114, which has the standard 170-passenger configuration and is now undergoing flight tests, will have a payload of 66,120 lb. He adds that the 120-passenger intercontinental model will be able to use its 600 mph. maximum speed on long-haul routes to compete with the best turbojet transports offered by the Russians or other countries.

The 120-passenger version will be used on routes from Moscow to countries outside the Iron Curtain as a propaganda vehicle. Most observers now feel that any solid progress toward a bilateral agreement between the U.S.



NAVIGATOR rides in Tu-114 nose. Sketch shows 170-passenger seating plan.



. . . lower deck houses kitchen, cargo.

World Market

and the Soviet Union for a New York-Moscow route will begin only after a fleet of the 120-passenger model is available.

Moscow-New York Nonstop

The intercontinental will fly nonstop from Moscow to New York in 10 to 12 hr., according to Russian sources. The plane also will be used on routes from Moscow to New Delhi, Vladivostok and Peking.

In addition, the 170-passenger version will fly nonstop from the Russian capital to New Delhi and probably will be used on such domestic routes as Moscow-Irkutsk and Moscow-Alma Ata.

Eger points out that on hops from Moscow to such southern vacation spots as Simferopol, Sochi and Mineralnye Vody, two 220-passenger Tu-114s, flying for two and one-half hours, will be able to carry as many passengers as an express train which requires two days to make similar trips. He adds that on routes where passenger traffic is subject to sharp seasonal changes, the double-deck Tu-114 can be used to handle large quantities of cargo and mail.

The Tu-114 is equipped with four Kuznetsov NK12 engines which, according to Eger "are almost twice as powerful as existing turboprop engines on foreign planes." Engines are similar to the turboprops which power the Bear bomber and develop about 12,000 eshp. each.

The plane can take off on three engines and maintain altitude with two engines operating on either side. Landing gear is similar to the Tu-104's. Cabin pressure when flying between 36,000 ft. and 39,000 ft. corresponds to an altitude of about 7,900 ft. Air in the passenger compartments is changed 24-25 times per hour.

Design Technique

The Tu-114 represents a major step forward for the Russians in developing design techniques that result in increased efficiency and lower cost of operation. Cargo and baggage bins have been made more accessible, provisions for fast ground handling are incorporated in the design, and fuselage layout has been arranged to accelerate in-flight passenger service.

Russians also have shown marked progress in attaining high-density seating configurations, a factor likely to create customer appeal among smaller nations. In addition, designers have diverted courses sharply in styling interiors by replacing the cumbersome mid-Victorian decor of earlier planes with an ultra-modern motif.

Lightweight metals, foam rubber cushions and plastics are now used to increase payload, improve efficiency and brighten interiors. Walls and ceilings are decorated in bright tones. Both the Tu-104 and the Tu-114 use a non-combustible plastic called "Pavinol" by the Russians to cover bulkheads so they can be washed and disinfected.

On the standard 170-passenger and intercontinental 120-passenger models, the forward cabin will be equipped with 41-seats arranged six-abreast for "second-class" service.

Cloak rooms on both sides of the aisle serve as bulkheads to separate the forward and center passenger cabins on all three Tu-114 configurations.

Restaurant Localities

Standard and intercontinental models will have a "restaurant-type" center passenger cabin with eight tables, each with six chairs. The tourist version will carry 66 seats in the center cabin with two tables.

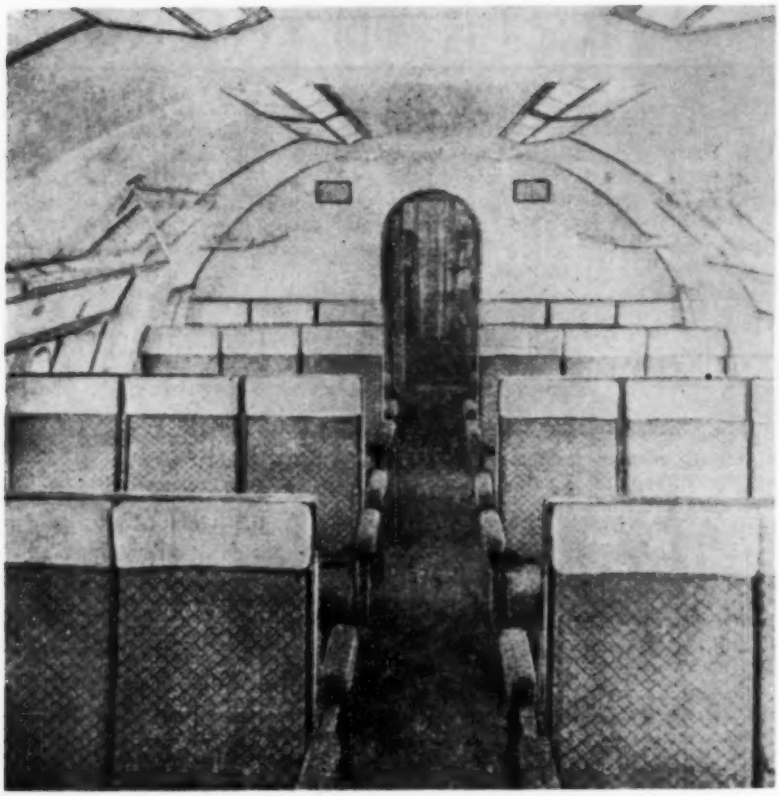
To the rear of the center cabin will be located the buffet that will be connected with a lower deck galley by two electric elevators—one for hoisting prepared food, the other for returning dirty dishes.

Thus the food preparation area is isolated from passenger cabins.

To the rear of the buffet, on the right side, will be a stairway to the lower deck. On the left side will be a small cabin for three passengers.

All versions of the Tu-114 will have four roomettes—two on each side of the aisle—just forward of the third passenger cabin. Each roomette will be equipped with either six seats or three sleeping berths—two divans and a folding upper berth. The roomette seats apparently

FOUR turboprop engines power Tu-114. Cantilever monoplane has swept-back wings.



FORWARD passenger cabin on Tu-114 shows western motif in seating arrangement.

are not included in the seat count of the 120-passenger model.

Rear cabin on the standard version will accommodate 54 passengers in "second-class" seats, three abreast on each side of the aisle. The long-range 120-passenger model has a first-class rear cabin with more comfortable and larger seats for 28 persons. Tourist model has 76 seats in blocks of four and three in the rear compartment.

The plane's tail section contains large cloakrooms and washrooms.

On normal routes, crew will consist of two pilots, navigator, engineer, radio officer and three stewardesses.

TCA Route Monopoly Ordered to Be Broken

Ottawa—Plans of the Canadian government to introduce competition over its transcontinental air routes will break a monopoly held by Trans-Canada Air Lines since 1936 when the airline was founded.

Decision to change the long-standing government policy against competition was disclosed earlier this month when Canadian Transport Minister George Hees said in a speech at Timmins, Ontario, that competition will be introduced "on domestic air routes on a gradual basis where economic conditions warrant."

Possibility that Canada's new ruling party, the first Conservative government in 22 years, would open the country's east-west routes to one or more Canadian carriers was predicted last summer by AVIATION WEEK (AW July 15, p. 45). Final decision as to which airlines and how many would be granted operating authority will be up to the Canadian Air Transport Board.

Historically, the board has ruled against the addition of a second carrier to serve the country's transcontinental routes because of the government's stand against competition. That a switch in government policy was in the making, however, was first indicated by a board action last year when several of Canadian Pacific Airlines' short-haul routes were transferred to smaller airline operators (AW Sept. 2, p. 47).

Both Canadian Pacific Airlines and Pacific Western Airlines have filed applications with the Air Transport Board for routes from Vancouver to Eastern Canada. At present, Canadian Pacific domestic scheduled operations are confined to Western Canada. Pacific Western conducts an extensive charter operation.

Hees said discussions are to be held in the next few weeks with the U.S. on new routes between the two countries. However, before any new domestic or international routes are awarded by the board, a study of the transcontinental route problem is to be conducted by Stephen Wheatcraft, British aircraft consultant formerly with British European Airways.

Canadian Pacific Airlines president, G. W. G. McConachie, said in Vancouver that his airline would operate either the Bristol Britannia turboprop or the de Havilland Comet 4 turbojet on any transcontinental route granted it by the board.

Smaller airlines in Eastern and Western Canada, operating out of Winnepeg and Montreal, were expected to apply for feeder-line routes to link the transcontinental routes with present operations in Northern Canada.

Hees emphasized that competitive airlines obtaining domestic routes would also be expected to serve points which need air service but which are not self-sustaining.

TWA Negro Hostess

New York—Trans World Airlines has agreed to hire a Negro flight hostess within 90 days in what the New York State Commission Against Discrimination has called a second major breakthrough in airline hiring of flight personnel. Mohawk Airlines last December hired Ruth Taylor, a Negro, as a stewardess.

TWA, in promising the commission to make every effort to find a qualified Negro girl for the job, said its policy always has been non-discriminatory but it has not previously been able to locate qualified personnel. The airline plans to "intensify and broaden" its recruiting activities, the commission was told.

In another matter, a discrimination case now pending against TWA has been postponed until May 12 without prejudice to either side.

Turboprop Convairs Ordered by RCAF

Montreal—Ten turboprop versions of the Convair 440 will be built for the Royal Canadian Air Force by Canadair, Ltd., Montreal subsidiary of General Dynamics Corp.

Aircraft, designated CL-66, will be powered by British Napier Eland-6 engines and will be offered by Canadair to world airlines in a commercial configuration. Two will be delivered to the RCAF this year. A 340 fitted with Elands has been demonstrated to the RCAF and now is undergoing U.S. CAA certification tests.

RCAF plans to buy about 36 Eland engines for $3.7 million on initial order. Napier production is planned to go to 120 to 130 engines a year. Company has order for 12 engines for three REAL Brazilian airline planes, with options on

another 56 engines for the remaining 17 aircraft.

Convair Division of General Dynamics now is phasing out Liner production at San Diego, Calif., to make room for its 880 jet transport. Canadair will take over complete tooling system and set up production at Montreal.

Aircraft will be known as the Cosmopolitan. Officials feel combination of proven airframe with turboprop engines will give Cosmopolitan world-wide sales appeal (AW Dec. 30, p. 64). New plane will have a gross weight of 53,200 lb. and will cruise at 326 mph., carrying 44 to 60 passengers or 10-15,000 lb. of cargo on a 1,700-mi. range. RCAF said CL-66 will complement the CL-44 four-engine turboprop aircraft Canadair is now building.

Engineers Gain Separate Hearing In ALPA-Eastern Negotiation Snarl

By Glenn Garrison

New York—Flight Engineers' International Assn. won the first point in hearings begun here last week by an emergency Presidential Fact Finding Board seeking to unsnarl blocked negotiations between both FEIA and Air Line Pilots Assn. with Eastern Air Lines (AW Feb. 10, p. 43).

ALPA, scheduled for a separate hearing before the three-man board in its bargaining for a new contract with Eastern, sought to consolidate its case with the flight engineer, because of the overlapping of a major issue—who will be the third man in the cockpit. The pilot's group insists that jet flight engineers be certificated as pilots instead of mechanic-engineers as is presently the case. The flight engineers want their contract to guarantee the presence of a flight engineer in Eastern's planes.

ALPA suggested to the Board that it was "highly artificial" to keep the two cases apart as though they were not related. The flight engineers retorted that the pilots hadn't any business in their case and that theirs was a separate dispute with Eastern.

Technically there are two boards: Emergency Board No. 120 set up to hear the FEIA-Eastern case, and Emergency Board No. 121 set up for the ALPA-Eastern hearing. The board members, under the chairmanship of David Cole, went into off-the-record sessions with the flight engineers, pilots and airline to straighten out the procedural hassle, and decided to keep the cases apart. The board is hearing FEIA's case first, then Eastern's response. Then it will hear ALPA's case and the airline's reply, and will in the meantime ask either union to respond to questions where overlapping issues are involved.

The flight engineers' opening statement listed "protection of rights of representation" and "a modest form of union security" among its major demands and accused the pilots' group of "pressures on management" and seeking to coerce the carrier into writing the pilot requirement into a new contract with ALPA.

Other issues outlined by Counsel Bernard Cushman for the flight engineers included rest periods, pay guarantees, deadhead pay, pension plan, travel and moving expenses, bidding of assignments, military leave pay, scheduling and training. The flight engineers want their flight pay formula to become effective at the time of checkout rather than after two years of service, and they want hourly increases of $.70 for daytime flights and $1.05 for night flying. They also want an agency shop.

Cushman said the airline industry lags in so-called fringe benefits. On union security, he said "it seems incongruous at this stage of American labor relations that a union should have to come before an emergency board and ask for security."

W. Glen Harlan replied for Eastern that the "imaginary issue over the third man in the crew cockpit" had assumed "wholly unwarranted proportions." It was too bad, Harlan said, that Eastern should have been subjected to harassment by both the flight engineers and pilots, and the company hoped that in future both unions would refrain from obstructing proper collective bargaining.

Harlan said there never was any real basis for the flight engineers' "fears" that pilots would take over their jobs with Eastern. Eastern deliberately chose mechanic-qualified engineers on its big aircraft instead of pilot-engineers, he said, and has felt that way ever since and sees no reason to change.

Civil Aeronautics Administration rules, he said, always have given the carrier its choice between the two types of personnel and possibility that the rules might be changed is "purely speculative." Eastern had repeatedly said it doesn't plan to change its mind. According to Harlan, the reason it doesn't want to spell this out in the FEIA contract is that the proper crew complement of future aircraft cannot be specified at this time and the airline can't bind itself to a provision which might interfere with management responsibility in the area of safety.

Eastern has required mechanic qualification in the past, Harlan said, "to ease the imaginary fears of the flight engineers." He said Eastern "had the impression" that the flight engineers wanted to wait for their contract until ALPA-Eastern negotiations had opened, and only after the pilots had demanded the pilot qualification had the flight engineers' "real drive" begun.

De Havilland-BEA Contract Near

London—British government has authorized British European Airways to negotiate with a de Havilland group for purchase of 24 de Havilland 121 short to medium range jet airliners.

This means de Havilland virtually has won an $84 million contract and that the Bristol Hawker Siddeley Group's Bristol 200 has been rejected, aviation and government sources say.

Although BEA has been on record for some time as preferring the de Havilland 121, the government has held off negotiations pending evidence of the de Havilland group's ability to produce the aircraft without requiring government subsidy.

A de Havilland spokesman told Aviation Week BEA auditors have satisfied themselves that the group, including de Havilland, Hunting and Fairey, have financial, technical and production resources to support the program without aid on a basis of a minimum of 24 aircraft.

Group company, Airco, believes the de Havilland 121 program would break even after producing about 60 aircraft. Civil Aviation Minister Harold Watkinson told the House of Commons that negotiations between BEA and Airco will get underway immediately to settle final details of the contract. BEA has announced it will take options on 12 de Havilland 121s in addition to giving firm orders for 24 aircraft.

In accordance with government policy, BEA must delay formal announcement of the order until after the contract is signed and the final draft approved by the treasury.

De Havilland 121 has three tail-mounted Rolls-Royce RB-141 bypass engines each having 12,000 lb. thrust. Since the engine has a higher bypass ratio than the larger Conway from which it was developed, it is expected to have lower fuel consumption and may not need noise suppressors.

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AMERICAN AIRLINES

America's Leading Airline

American Cites Cost Of Switching to Jets

Washington—American Airlines told the Civil Aeronautics Board last week that high costs of converting to jet operations would send the carrier's expenditures for ground equipment alone up to $95 million by mid-1960.

Testifying before the Board in the second phase of the General Passenger Fare Investigation, American Vice President George C. Van Nostrand said biggest costs in introducing jet transports will come in the expansion of ground facilities and in training.

"No one can say exactly what this vast expansion will eventually cost American. . . . Moreover, our present facilities expansion program contemplates only expenditures necessary to permit introduction of jets at present airports without the radical changes in passenger handling which we know must be made eventually."

Van Nostrand told the Board that gate positions at airports must be equipped with special power, distilled water and jet fuel facilities. Special tools, shop and motorized equipment is expected to cost $14.8 million for 30 Boeing 707s and 35 Electras.

The airline's vice president of personnel, Paul W. Kayser, testified that training for the jets will be required by some 12,000 employes. He said that training costs for flight and maintenance personnel alone will be in excess of $8 million over the next three years.

Kayser said that American will purchase two flight simulators for training crew members at an approximate cost of $1.6 million. He added that the largest single group requiring training for turbine operations are maintenance and engineering personnel. Between 1957 and 1960, he said, time devoted to training this group will number approximately 695,000 hours.

Second phase of the General Passenger Fare Investigation covers long-range planning programs of the airlines. Each domestic trunkline and the Air Transport Assn. will testify in this phase of the investigation.

Teletype Link Speeds Teleregister System

Dallas—Braniff Airways has speeded passenger reservation service by connecting its system teletype network directly to a new electronic reservation system built here by Teleregister Corp.

New system gives 140 Braniff ticket offices in the U. S. a direct connection to an electronic means of reservation inventory control that has become increasingly popular with the airlines. Braniff's system maintains an inventory

COCKPIT VIEWPOINT

By Capt. R. C. Robson

Magic Lantern

Last July and August this column detailed the results of some all-weather instrument approaches made at Andrews Air Force Base. Among the various things learned from this approach-light testing was that a need existed for a training aid which would adequately simulate low visibility flying. Recently I had the opportunity to witness a remarkable step in this direction—a system designed by Ward Davis of Doman Helicopters Inc.

In the way of background, Davis, while with the CAA many years ago, worked with Ed Link on his first Link Trainer. Later Davis became the first operator of CAA's first machine.

During World War II his talents in the training and simulator field were consigned to the Navy and to this day his interest in the subject has not faded. Mr. Davis has generously credited this column with being responsible for the emergence of his device.

Simplicity Simulator's Virtue

Basically Davis' idea, called the Dalto Simulator (Doman Approach, Landing and Takeoff), is simplicity itself. It is no tube-studded maze of wiring. It is an endless belt on which is portrayed any type of approach or runway lights or markings you care to see. (I care to see centerline and apparently Davis does too for that's what his breadboard model shows.)

The belt is put in motion and simply photographed with a movie or TV camera. The belt is perforated at the proper places so that light bulbs underneath can glint through in almost perfect reproduction of stroboscopic flashers. Appropriate filters can produce any visibility you care to encounter. Although it sounds too simple to be true, the illusion is real to the extent that one is moved to use body English when high, or off to one side, approaches are shown.

Here is the way the device will be used: Take any simulator. Mount the movie projector atop the cockpit facing a screen several feet away. Wire the camera controls to the artificial horizon, altimeter, airspeed, etc., and away you go.

You can flare, roll, dive or pull up; the camera reacts accordingly and the corresponding picture appears through your windshield.

Most Simulators Are Limited

Numerous other visual devices are in existence today in various stages of perfection. Mostly however, these portray fairly good weather—conditions on the order of 3,000 ft. ceilings and 3-mi. visibility, down to as low as 600 ft. and ½ mi.

While of some use for airport qualifications and for training relatively new pilots, etc., their use does appear limited. Portraying a circling approach or a gas truck driving down the ramp may be pretty but it completely ignores the really short-hair conditions.

In contrast to this the Dalto device begins at 300 ft. ceilings and ½ mi. visibility and goes on down to 300 or 400 ft. visibility—even less if you like—(I don't). And this is the crux of the matter.

A pilot who can handle very low visibility stuff does not have to worry about a 3 mi. condition.

These days, when we are asking pilots to take some mighty expensive pieces of aircraft in and out of some mighty crumby airports, let us at least acquaint them with some of the worse conditions. The Dalto device appears to be a good way to start doing this and it has the added beauty of being a relatively economical method.

First public showing of Davis' "magic lantern" was scheduled for this month. From what I've seen, and what I remember of the Andrews tests, the audience will see some mighty realistic sights.

Better performance, comfort and appearance for your business airplane!

CONVAIR 240 INTEGRAL STAIR DOOR, *an AiResearch modification, combines high efficiency with light weight and smart appearance.*

INSTALLATION OF WING TANKS *by AiResearch brings capacity to over 2000 gallons, adding extra hours to range of Convair 340 and 440. (Added fuel capacity also available for Convair 240.)*

CONVAIR 340 or 440 RADAR NOSE *is part of AiResearch conversion which includes radio, autopilot and new instrumentation.*

MAXIMUM EFFICIENCY *as an airborne office is combined with the utmost in comfort in this AiResearch custom interior conversion in a Convair 440.*

Come to AiResearch for the finest in conversion facilities, workmanship and service

The Convair conversions illustrated are typical of hundreds made on all types of business aircraft, including DC-3s, DC-6s, Lodestars and D-18s. A single visit to AiResearch Aviation Service can solve any conversion, modification or servicing problem you may have.

Here, in more than 150,000 square feet of floor space, we can install new instruments, larger engines, extra fuel tanks, the finest in radio and radar equipment and new, complete electrical and hydraulic systems. And we can provide the finest interiors custom-tailored to your individual requirements.

In addition, we can satisfy all your service needs from turn-around service to complete overhauls. You are invited to inspect our facilities. Please write or telephone for full information.

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on 250 flights a day for 31 days in advance.

Observing that Braniff's is the first direct hookup of its kind in the industry, the airline's president, Charles E. Beard, said: "Without the advantages of the Teleregister system we would soon be in our air age where our planes travel at such speeds that passengers aboard the aircraft would reach their destination faster than messages concerning their reservation could be handled."

Eliminating the time-consuming operation of manually posted reservation control charts, the new hookup automatically transfers reservation messages coming by teletype into the Braniff message center to the Teleregister facility.

Messages are received by Teleregister on four leased circuits and filtered through two electronic editors which eliminate such extraneous data as information about car rentals and hotel reservations. Inventory information then runs through an electronic translator, through two data processors and to storage on a magnetic drum. The two data processors run simultaneously in parallel and are cross-checked.

Teleregister operates the inventory facility at a site near Love Field, and Braniff leases the service. The carrier's present reservation load uses about half of the system's inventory capacity.

Teleregister operates reservation systems for American Airlines, National Airlines, Northeast Airlines, Pan American World Airways, and United Air Lines, and the company is building systems for Trans World Airlines and Western Air Lines. None of these other systems, however, is directly linked to a system-wide teletype network.

SHORTLINES

► **Air Transport Assn.** reports business transactions through the Airlines Clearing House were up 13% in December as compared with the same month of 1956. Total interline business for December was $59,687,082.55 against $52,822,790.50 in December, 1956.

► **American Airlines carried** a record 643,000 passengers more than 412 million revenue passenger-miles in January, an increase of 3% and 0.7% respectively. The previous January record, set in January, 1956, was 624,000 passengers flown 409,400,000 revenue passenger-miles.

► **Civil Aeronautics Board Examiner** has recommended that Continental Air Lines' certificate be revised to permit single-plane service between Colorado Springs and Los Angeles and Chicago.

AIRLINE OBSERVER

► Airline stocks continued to show some strength in market activity during the first part of last week. Capital Airlines common stock, which dropped to a 1957-58 low of 9⅞ on Jan. 3, recently climbed to a high of 18¼ and has been one of the most active stocks among airline listings. TWA also has been an active issue but the relatively large volume of trading has not changed its price substantially.

► **Douglas DC-7 series has been certified by the Civil Aeronautics Administration to operate up to 28,000 ft., 3,000 ft. above the previous altitude limit. As yet, no airline has announced plans to boost flight altitudes to the new level.**

► United Air Lines has broadened its management base by promoting seven officers to senior vice presidencies and electing 17 new vice presidents. According to United President W. A. Patterson the enlarged management staff is based upon an anticipated traffic increase in 1965 of more than double last year's volume.

► **Chicago Helicopter Airways' purchase of two additional Sikorsky S-58 helicopters (AW Feb. 3, p. 40) brings the carrier's fleet of the 12-passenger helicopters to a total of five. The additional helicopters will increase seating capacity of present scheduled flights from 871 to 1,032 per day.**

► Soviet Russia claims its Tu-104 recently flew the 4,350 mi. route from Moscow to Vladivostok in 11 hours during a test flight. Aeroflot is scheduled to place a Tu-104A in regular service on this route this month.

► **Civil Aeronautics Administration granted $6.5 million in January for airport improvement and development in 13 states, bringing the total amount granted during the first seven months of the current fiscal year to $32 million. Among the more sizable grants are Los Angeles International Airport, Greater Cincinnati Airport and Theo. Francis Green Airport of Providence, R. I.**

► Total of 10 international airlines have agreed on kerosene with a freeze-point of −50C as a common jet fuel for turbine aircraft operations. Agreement does not set an international standard or affect carriers preferring JP4 fuels but is a major step toward reaching supply, distribution and storage economies.

► **Eagle Airways has been recommended by a Civil Aeronautics Board examiner for a foreign air carrier permit authorizing service between Bermuda and New York. Eagle is a Bermuda corporation created by the Bermuda legislature. The carrier will operate Viscount 800 turboprops on lease from Eagle Aviation Ltd. of England. The British firm also will provide pilots, maintenance and administrative personnel to conduct the service which contemplates an initial frequency of five roundtrips per week between Bermuda and the U. S.**

► Sen. Hubert Humphrey (D.-Minn.) has introduced a resolution calling for an investigation of International Civil Aviation Organization's activities in the field of airport economics and airport-user charges. Humphrey charges that, although ICAO "has never been granted any power to fix or regulate airport-user charges at American airports, (it) has nonetheless undertaken to promulgate and distribute throughout the world a statement purporting to establish principles governing all aspects of airport economics."

► **Pan American World Airways will construct a jet overhaul base on its Miami facility at a cost of between $15 million and $20 million. Construction will begin July 1.**

► Trans World Airlines set an all-time January record last month by completing 98.3% of its schedule mileage in the U. S. The airline scheduled an average of 273,000 mi. daily and completed a total of 8,260,000 for the month. TWA credited dependability of winter flying, obtaining full use of its new $25 million system overhaul base and improved operating and servicing procedures.

Airline Traffic—Year 1957

	Revenue Passengers	Revenue Passenger-Miles (000)	Load Factor %	U. S. Mail	Express	Freight	Total Revenue Ton-Miles	% Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American	7,512,835	5,042,291	64.9	19,884,279	8,998,777	82,486,146	596,309,679	57.7
Braniff	2,004,055	870,606	58.7	3,114,843	1,419,089	5,077,171	93,178,301	47.3
Capital	3,949,844	1,513,845	58.9	5,167,613	2,373,007	4,516,907	157,104,115	47.5
Continental	828,659	363,254	53.9	1,083,298	457,645	1,560,822	37,977,569	44.6
Delta	2,654,092	1,319,334	59.3	4,247,937	2,881,983	9,003,602	143,065,719	54.9
Eastern	7,819,621	4,398,358	59.52	11,202,767	5,297,267	15,636,344	456,330,425	47.00
National	1,351,969	897,600	50.7	3,227,868	610,828	5,194,202	96,135,268	50.2
Northeast	764,882	246,095	47.4	517,282	248,591	645,483	24,980,344	40.3
Northwest	*	947,409	57.2	4,727,264	2,471,509	9,426,564	107,679,166	50.2
Trans World	4,537,311	3,661,759	62.8	12,478,062	7,345,486	25,517,748	396,502,131	55.6
United	6,192,765	4,615,944	64.5	28,464,620	9,552,104	56,636,989	537,991,131	56.3
Western	1,369,964	687,661	60.0	3,084,135	1,095,196	2,890,782	72,792,257	54.1
INTERNATIONAL								
American	136,318	100,303	61.9	155,808	5,221	3,577,553	14,375,725	66.3
Braniff	43,820	92,381	52.8	236,931	.....	871,695	11,258,882	49.5
Caribbean-Atlantic	226,501	16,048	54.0	18,300	.....	39,290	1,742,124	59.0
Delta	69,040	81,715	62.3	85,360	.....	604,855	9,801,721	54.6
Eastern	325,517	446,960	55.12	1,059,959	.....	1,129,620	47,342,655	52.28
National	78,086	55,660	48.2	109,503	49,681	367,361	6,377,148	47.1
Northwest	*	261,915	55.4	12,326,644	231,660	7,670,879	48,130,395	67.5
Pan American								
Alaska	*	77,778	58.8	434,119	.....	2,553,510	11,061,800	51.9
Atlantic	1,084,070	1,439,933	64.5	13,972,857	.....	25,551,831	191,499,629	61.6
Latin America	*	1,289,706	65.7	4,652,319	.....	50,290,509	179,293,213	63.6
Pacific	*	1,125,920	64.9	12,444,039	.....	18,422,699	148,008,571	59.0
Panagra	139,409	173,736	58.2	740,605	.....	4,533,261	24,455,853	60.2
Trans World	280,453	734,739	63.6	10,046,912	.....	8,750,326	95,912,332	65.2
United	100,888	252,364	66.8	1,289,087	.....	813,326	27,898,672	61.9
Western	9,689	15,066	52.8	6,493	.....	39,902	1,675,714	55.8
LOCAL								
Allegheny	440,389	77,011	44.3	100,690	202,791	171,431	7,826,483	44.2
Bonanza	150,423	33,044	45.4	51,151	27,829	74,419	3,312,115	43.7
Central	118,867	23,726	33.7	50,205	26,543	86,383	2,436,625	30.1
Frontier	219,360	59,343	50.5	214,637	91,389	745,782	6,747,030	60.3
Lake Central	160,784	25,549	37.3	32,900	160,526	.....	2,641,417	39.7
Mohawk	*	81,405	48.2	72,362	160,925	250,624	8,253,058	48.9
North Central	658,810	106,723	46.8	255,460	364,478	.....	10,843,896	47.6
Ozark	390,753	63,835	41.4	133,777	186,102	163,434	6,584,376	43.3
Piedmont	401,168	83,808	53.8	161,235	115,884	167,511	8,474,141	53.3
Southern	211,916	38,318	40.2	115,057	129,797	2,638	3,919,780	39.3
Southwest	337,200	72,994	53.5	113,555	54,949	78,992	7,206,536	51.6
Trans-Texas	243,348	55,330	38.4	166,460	95,785	281,706	5,823,430	38.7
West Coast	254,062	45,128	48.68	52,693	256,683	59,983	4,445,150	45.96
HAWAIIAN								
Hawaiian	*	62,907	58.8	49,154	.....	1,427,977	6,731,576	56.7
Trans-Pacific	180,168	28,192	56.6	15,199	.....	126,947	2,333,566	57.6
CARGO								
Aerovias sud Americana	.....	.....	.....	.....	.....	8,848,739	8,848,739	80.9
Flying Tiger	107,771	492,259	99.4	449,470	422,116	82,986,089	133,083,668	82.6
Riddle	.....	.....	.....	510,715	323,532	31,554,701	32,389,008	73.8
Seaboard and Western	*	261,896	100	.....	.....	17,938,744	44,129,030	74.7
Slick	71,137	317,968	96.29	846,240	719,265	49,799,653	83,267,877	77.09
HELICOPTER								
Chicago Helicopter	55,310	895.1	34.4	26,411.8	.....	.....	111,906.6	30.4
Los Angeles Airways	31,283	1,131	51.6	46,415	22,511	4	177,219	58.9
New York Airways	*	1,276	38.5	19,360	11,407	7,037	160,071	41.4
ALASKA								
Alaska Airlines	57,541	16,817	45.3	353,894	.....	1,859,877	3,847,112	48.0
Alaska Coastal	51,841	4,629	63.6	48,116	.....	48,425	568,544	64.5
Cordova	19,738	5,135	55.2	42,865	.....	1,439,232	1,995,790	49.3
Ellis	63,168	3,382	56.5	24,049	.....	32,545	400,243	67.7
Pacific-Northern	107,875	105,820	52.8	1,120,959	.....	2,984,863	15,564,481	60.8

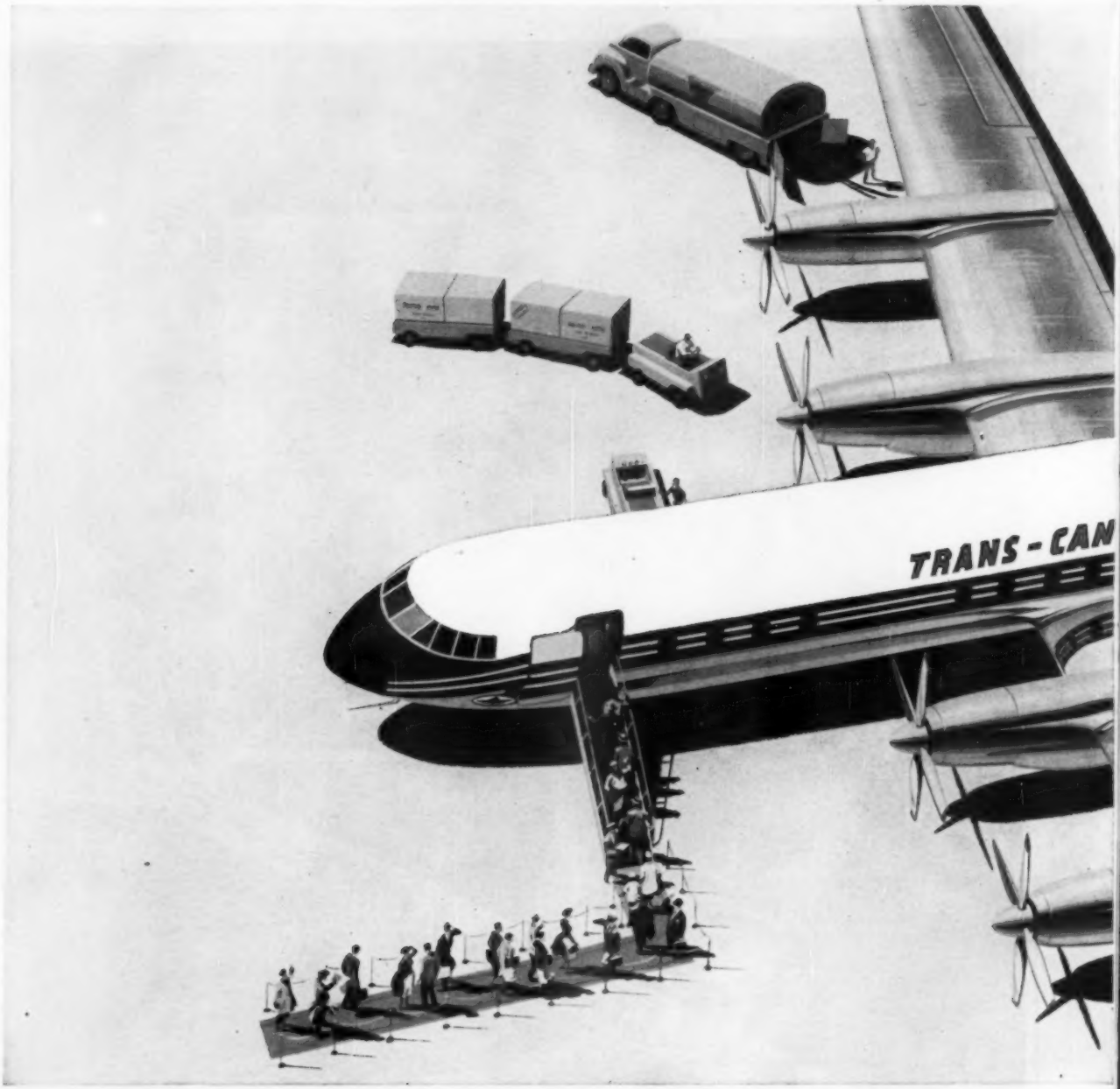
* Not available.
Compiled by Aviation Week from airline reports to the Civil Aeronautics Board.

HOW TCA CHOSE THE VICKERS VANGUARD

In announcing the decision of Trans-Canada Air Lines to purchase twenty jet-prop Vickers Vanguards (with an option on four more), Mr. Gordon McGregor, President of TCA, said:

"Our decision to order the Vanguard came after the most exhaustive equipment analysis ever undertaken by the company. The evaluation was made over a period of two years, during which ten other competing aircraft were thoroughly examined."

Here are the seven reasons →



Why TCA chose the jet-prop VANGUARD as its medium-long-range airliner

1. REMARKABLY LOW OPERATING COSTS.

TCA proved the Vanguard would be the most economical Jet Age airliner for its high-density, medium-range stage lengths. Mr. McGregor commented, "We expect to operate it at remarkably low aircraft and seat mile costs." Break-even load factors will be under 50% on all stages.

2. BEST OPERATIONAL FLEXIBILITY.

The Vanguard will be the most flexible Jet Age airliner. It will operate profitably on 200 to 2500 mile stages. On medium-range routes its flight time will almost parallel that of pure jets. With its well-balanced passenger and freight capacity, it will be a full-time money-maker.

3. GREAT PASSENGER COMFORT.

Powerful Rolls-Royce Tyne engines will make the Vanguard remarkably smooth and quiet. With the very wide fuselage, there is unparalleled layout flexibility. For first class, coach and mixed-class services, the Vanguard offers the roomiest and most flexible configurations.

4. PROVEN JET-PROP ENGINEERING.

The new Vanguard is a projection of the Viscount jet-prop principle... it will come into service with the built-in experience of more than 3,000,000 hours of Viscount operation. No other Jet Age airliner will have the advantages of this extensive commercial background.

5. LESS NOISE, SHORT TAKE-OFF.

The jet-prop Vanguard will be exceptionally quiet outside as well as inside the cabin. With its short take-off run, the Vanguard, despite its great size, will be able to use the existing runways at most of today's airports. Result: great routing flexibility, high utilization.

6. LARGE FREIGHT CAPACITY.

The Vanguard has two large under-floor cargo holds (each with large, truck-bed level doors) totaling 1360 cu. ft. capacity. This represents a perfect balance of passengers and freight—giving the Vanguard the biggest profit potential by far of any contemporary airliner.

400 mph plus... 2500-mile range... up to 120 passengers... up to 10 tons of freight

7. QUICK TURN-AROUND EASE OF MAINTENANCE.
The Vanguard promises more air time, less ground time. Check points are readily accessible, nacelles open easily, major engine change is simplified. With large doors, fore and aft, in both freight and passenger decks, payload handling is fast. Ground maneuverability is excellent.

NEWEST from the world leader in jet-prop aircraft...VICKERS

TCA's routes and requirements are very similar to those of many American carriers. In fact, 92 of the 100 busiest routes in the U. S. can be economically served by the great new jet-prop Vanguard. A Vickers engineering team—thoroughly familiar with the problems of American lines—stands ready to answer your specific questions. If you would like them to call, at your convenience, simply contact: Christopher Clarkson, U. S. representative, 10 Rockefeller Plaza, New York 20, N. Y.

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POWERED BY FOUR ROLLS-ROYCE TYNE ENGINES

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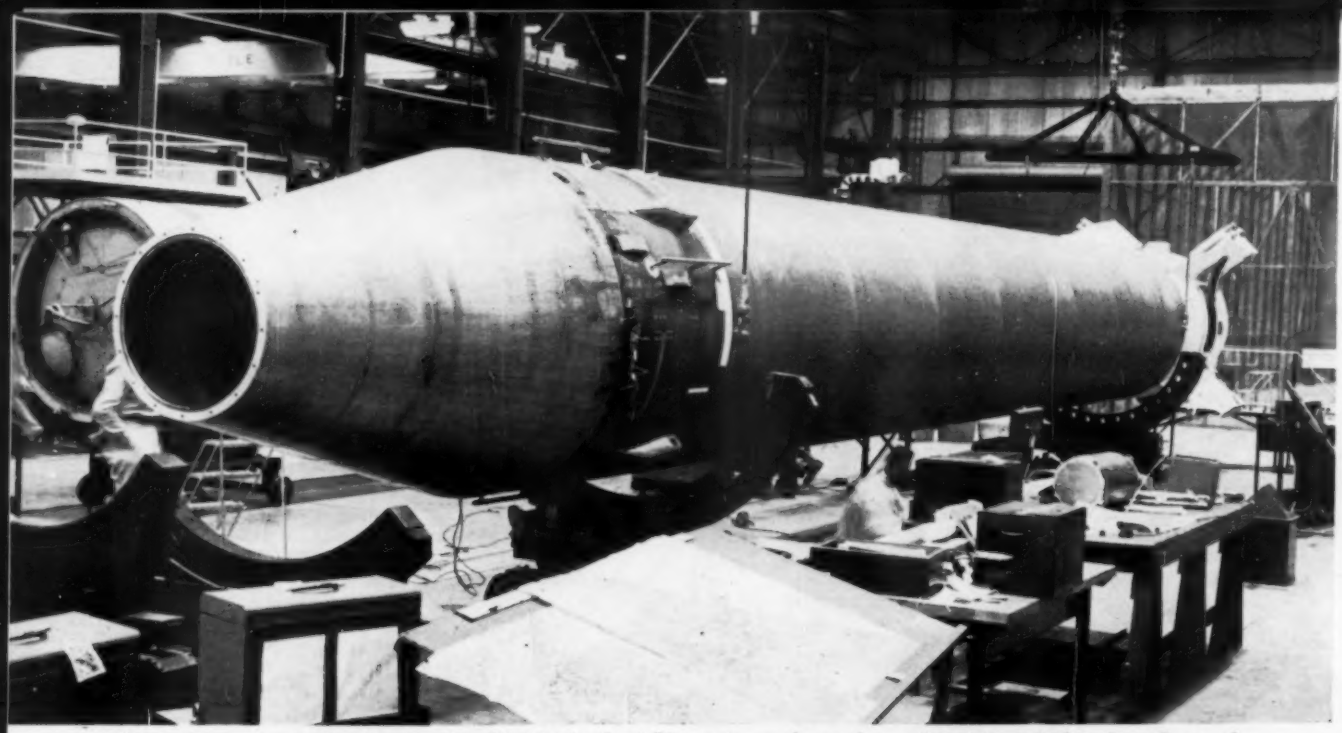
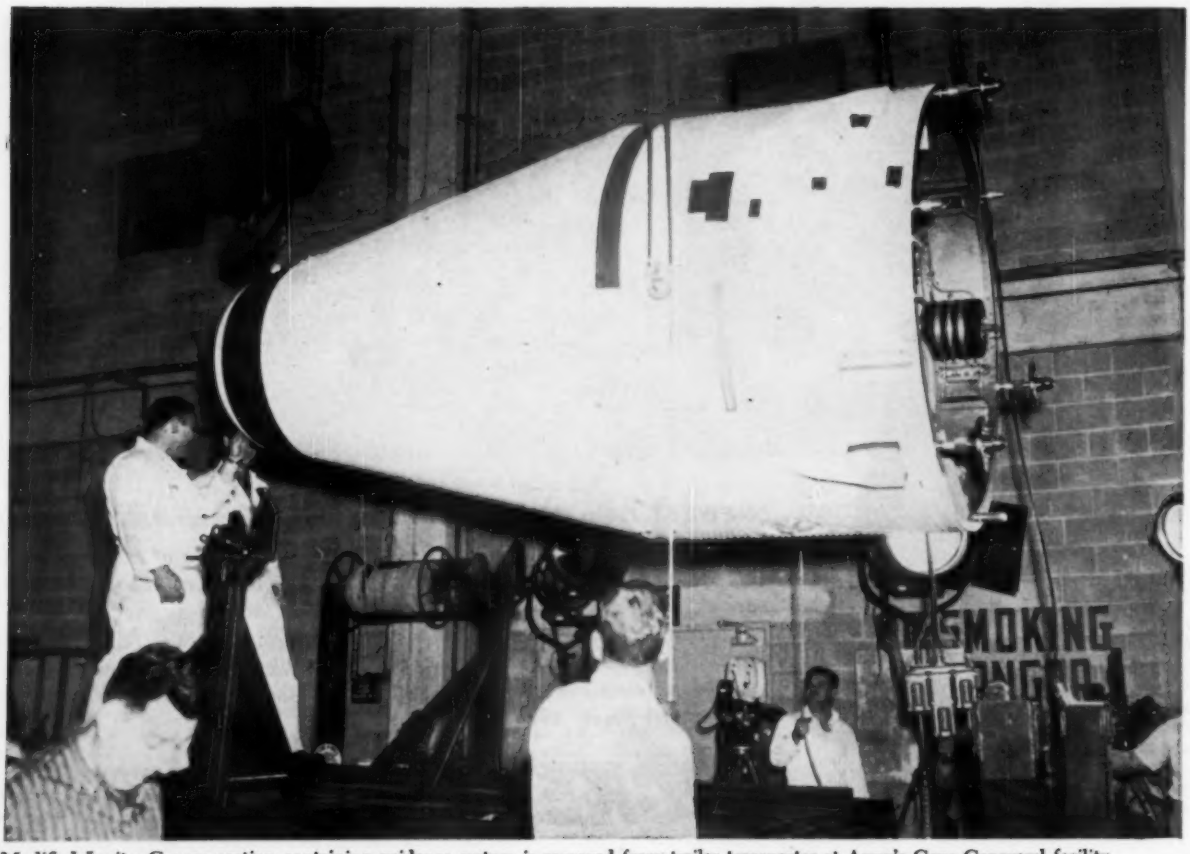


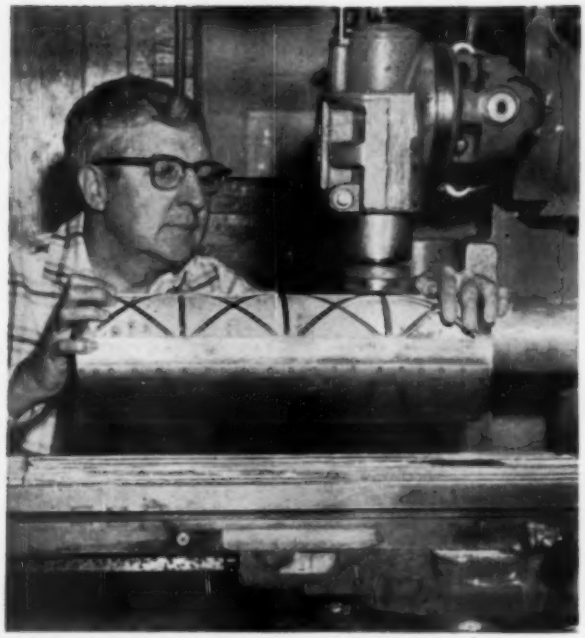
Nose section and main stage booster of modified Jupiter-C satellite carrier are shown after mating at Army facility, Cape Canaveral.

Army, JPL Assemble Jupiter-C Satellite Vehicle

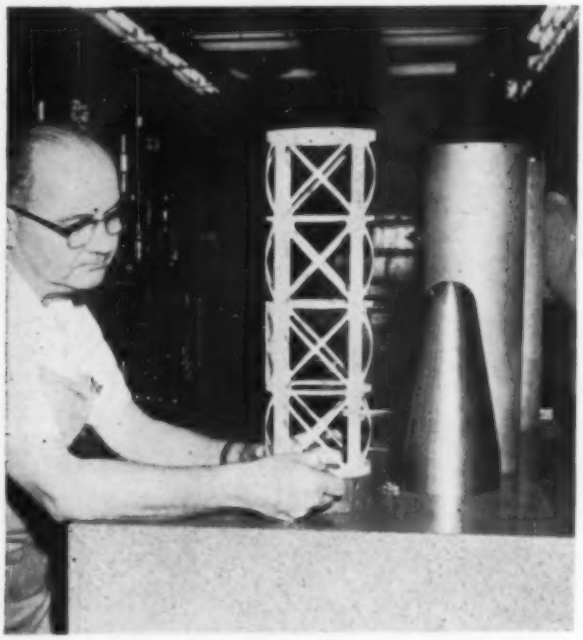


Modified Jupiter-C nose section containing guidance system is removed from trailer transporter at Army's Cape Canaveral facility.

MISSILE ENGINEERING



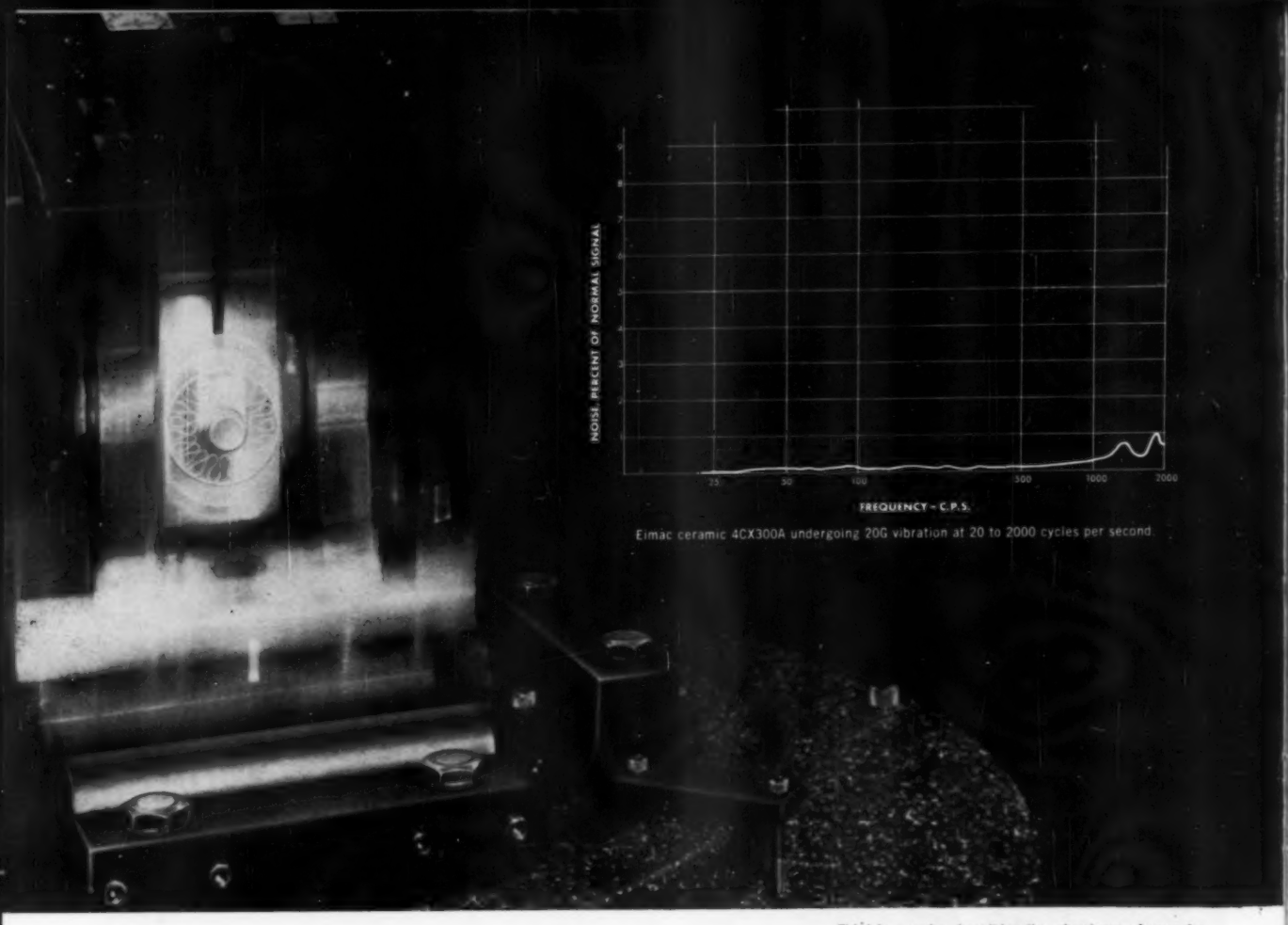
Fiberglas lattice sleeve, designed to hold the instruments contained in the Army's satellite, is machined at the Jet Propulsion Laboratory, California Institute of Technology.



Machined Fiberglas lattice sleeve is inspected by Jet Propulsion Laboratory employe. Sleeve, containing instruments, will be inserted in satellite's thin steel case and nosecone.

Instrument component of the satellite launched by the Army is prepared for shake table test at California Institute of Technology's Jet Propulsion Laboratory. Test was designed to simulate environment encountered in launching, space.

Instrumented satellite (upper section) and the final-stage solid-propellant rocket (lower section) were developed jointly by the Jet Propulsion Laboratory and the Army. Assembly weighs 30.80 lb. Overall length is 80 in.



Eimac ceramic 4CX300A undergoing 20G vibration at 20 to 2000 cycles per second.

Third in a series describing the advantages of ceramics in electron tubes. Previously discussed: impact and heat.

Surviving Vibration is an Eimac Ceramic Tube Extra

High reliability in severe environments is an important vacuum tube requirement in many aeronautical applications. An important aspect of this reliability is a tube's ability to operate under extreme vibration without envelope damage, introducing noise or developing interelectrode short circuits. Eimac ceramic design incorporates many advanced features that improve tube performance under these conditions.

In the illustration an Eimac ceramic 4CX300A, 300 watt tetrode, is being operated in a circuit while undergoing 20G vibration at 20 to 2000 cycles per second. The exceptionally low noise level, produced under these conditions shown in the graph above, remains less than 1% of normal signal over the entire test range.

Other advantages of Eimac ceramic tubes are: resistance to damage by shock or high temperature; compactness without sacrifice of power; ability to withstand rigorous processing techniques that lead to high tube reliability, uniformity and longevity.

In its new line of ceramic tubes, Eimac has the answer for the aeronautical engineer who needs a tube that will deliver full output under extreme environment.

Write our Application Engineering Department for a copy of the new explanatory booklet "Advantages of Ceramics in Electron Tubes"

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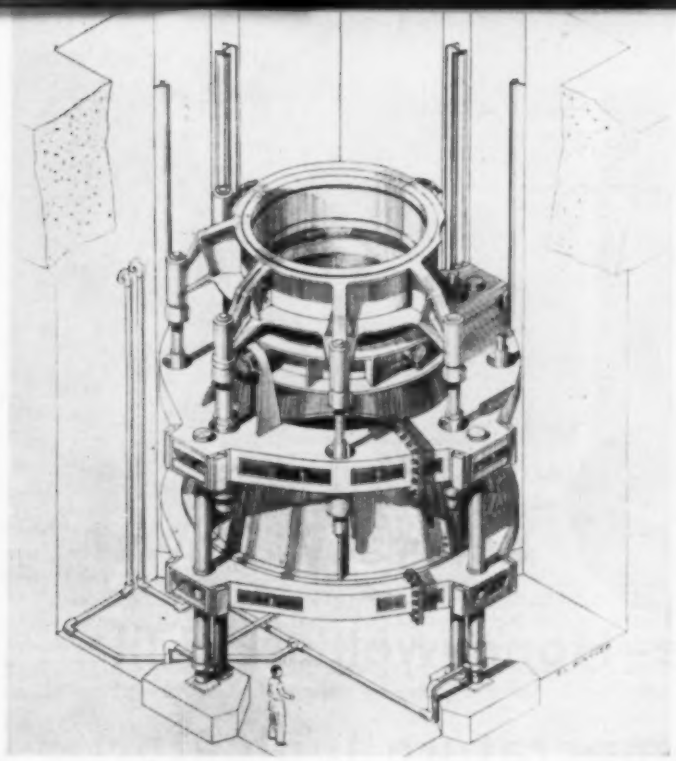
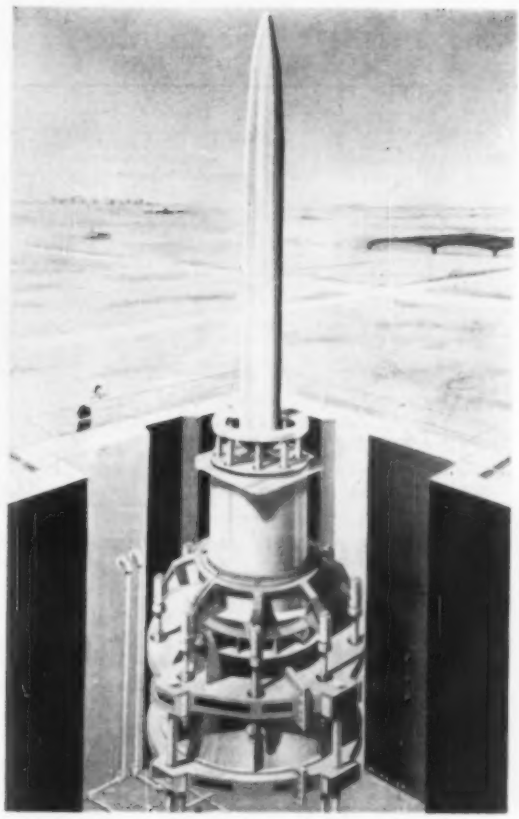




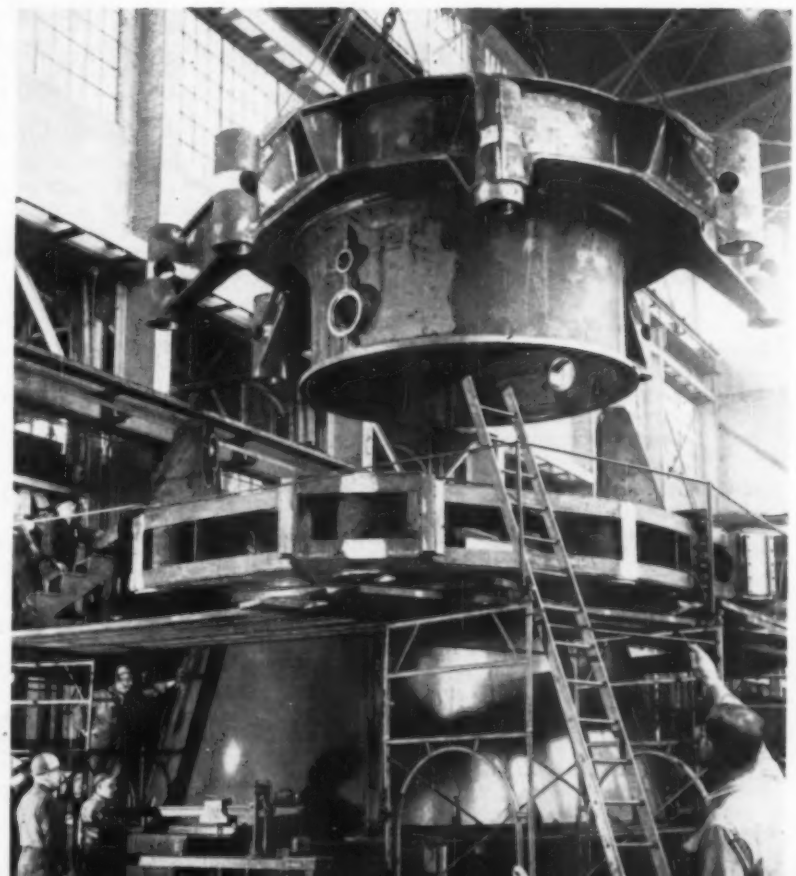
Major Parts Being Mated For Polaris Ship Simulator

New York—Rapid progress is being made in completing a 285,000 lb. Ship Motion Simulator being built to subject Navy's Polaris intermediate range ballistic missile to the three important motions of a ship: heave, roll and pitch.

Simulator, which was designed by Loewy-Hydropress Division, Baldwin-Lima-Hamilton Corp., is designed to duplicate motions to which the Polaris would be subjected if mounted on the deck of a ship, such as the nuclear-powered guided missile cruiser U.S.S. Long Beach, or those produced by an atomic-powered submarine. Although the same basic criteria exist whether the missile is deck- or submarine-mounted, there is a considerable difference in missile's center of gravity location in relation to ship center of gravity. If deck-mounted, missile and ship centers of gravity are vertically separated by a considerable distance; if submarine-mounted, centers of gravity are relatively close together. Loewy's simulator provides an adaptor which makes it possible to locate the missile so that its center of gravity will be correctly located for either condition.

Construction of the massive machine is progressing at Bethlehem Steel Co.'s Bethlehem, Pa., plant, where major components are being mated.

At Patrick AFB, Fla., a 50-ft.-deep concrete-lined pit designed to house



Its greater accuracy allows longer engine life—Honeywell's EGTI (Exhaust Gas Temperature Indicator)

Pilot can now run engine at maximum performance temperature without damage. That's because EGTI's greater accuracy makes it unnecessary to allow for ordinary gage error to keep within safety range. Results: longer engine life, more accurate maintenance records, greater safety for pilot. Only transistor EGTI granted MIL installation approval.

Specifications

Available with integral switching and provisions for Engine Temperature Analyzing, Recording and Time-Temperature Integrating.

Applications: Exhaust Gas and Turbine inlet temperature indication system.

Input: 115 volts, 400 cps.

Power Consumption: 6 watts at .7 power factor.

Accuracy: ±5°C.

Range: 0° to 1000°C. or 0° to 1200°C.

Response: 3 seconds maximum, full scale travel.

Dial Sizes: 2-inch or 3-inch.

Warm-up: Instantaneous.

Temperature Range: —67°F. to +160°F.

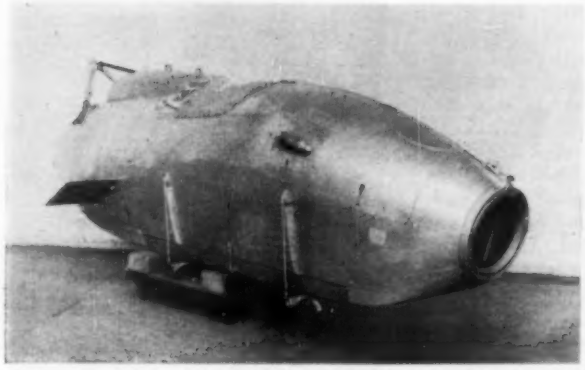
Length: 6.25 inches, basic unit.

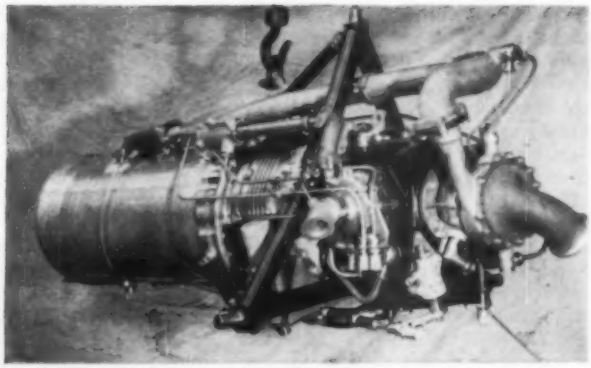
Weight: 0.9 lb. nominal, basic unit.

For further information write: Minneapolis-Honeywell Aero Division, Dept. AW-2-44, 2600 Ridgway Road, Minneapolis 13, Minnesota.

Honeywell

Military Products Group





Takeoff Unit Assists Victor, Vulcan Bombers

Constant thrust versions of the de Havilland Spectre rocket engine now are in production for the Victor and Vulcan bombers as assisted takeoff units. One will be fitted under each wing. Engine, complete with fuel and oxidant tanks and pumps, is installed in releasable nacelle which is dropped and used again. Absence of variable thrust mechanism and redesign to slash weight of original unit was announced last year. Nacelle is double-skinned in region of fuel and oxidant plastic bags. Nitrogen bottles pressurize the systems initially for starting. Both pumps can be seen with the high-test peroxide pump on right. Owing to short load period, a much smaller uncooled lubricating system for pump reduction gearing has been fitted. Engine is carried in rear of container; kerosene tanks are in middle, and high-test peroxide tanks in front. Single 36-ft. diameter parachute locates from center section. On release, an extractor gun fires pilot chute and ram air fills air bags along bottom of container to cushion landing shock. Perforations in bags act as damping orifices. Container has high negative incidence stabilizers and is mounted to wing level with engine canted inside.

the 36-ft.-simulator has been completed and work is progressing on an adjoining powerhouse which will contain all engines, drives and controls associated with the simulator (AW April 2, p. 61).

Among problems encountered in the design of the testing site were:

• **De-watering troubles.** Being built only a short distance from the coastline in typical Florida sand, an extensive de-watering system had to be devised to allow a hole 50-ft. deep to be dug successfully in an area where the water table is only 7 ft. below the surface. Once water had been pumped from the digging area, sheets of thin plastic material were buried vertically in the sand to keep the water out. Also, the entire concrete structure had to be made heavy enough to keep it from floating.

• **Ventilation of the powerplant** and pit is essential to make the areas habitable. Particular headache concerning the plant air supply was that it had to function correctly even at blast-off during which time the Polaris' exhaust might impinge almost directly on the building, and air intakes had to be designed so they could furnish air that could be breathed in spite of firing conditions.

Loewy-Hydropress developed all human environment criteria for the simulator site including items such as location of access roads, protection of operators, heating and ventilating, etc.

Heave, Pitch and Roll

The hydraulically-operated simulator, which borrows many techniques from Loewy-developed hydropresses, can duplicate any programmed series of ship motions.

The machine will have provisions for duplicating motions recorded on magnetic tape. The tape recordings will be made in an actual vessel at a later date. Peak ship movements will probably have to be lessened to avoid overstressing the simulator.

Other Uses

Other possible uses of the simulator would be to:

• **Test air ejection** system for the Polaris, using a dummy missile. Total weight of such a system would be about 140,000 lb.--100,000 lb. for the ejector and 40,000 lb. for the weighted dummy Polaris.

• **Test an encapsulated** human being to check effects of shipboard motions.

Machine is capable of duplicating heave motion with displacements up to 16 ft., roll or pitch up to plus or minus 14 deg. and simultaneous roll and pitch motion up to plus or minus 10 deg.

Company engineers developed a hydraulic counterbalance system in the simulator's hydraulic drive system which reduced total horsepower drive requirements by 700 hp.: from 3,700 hp. to 3,000 hp.

Man's Flexibility Held Asset in Space Flight

Los Angeles—Conviction that a human pilot is an asset in space flight was voiced here by Brig. Gen. Donald D. Flickinger, Air Research and Development Command director of human factors, and Scott Crossfield, experimental test pilot of North American Aviation Inc., before a sectional meeting of the Institute of the Aeronautical Sciences.

Gen. Flickinger said that for a cost of 5% or 10% in terms of weight, a human crew can improve reliability, efficiency and economy by as much as 70%. Crossfield amplified this when he pointed out that the insertion of a human pilot vastly simplifies servo loops because of the variety of functions he can perform. By simplifying, he enhances reliability, cuts weight and reduces logistic requirements.

Both men noted that a human crew will give the aircraft or missile system a flexibility of response to circumstances that can be had in no other way. Crossfield said that very few military missions take place exactly as planned. The man programming a mission on the ground cannot anticipate enemy counteraction or any of the number of chance factors which can intervene to make his plan worthless and wasteful. Regarding the chance factors, Crossfield observed that manufacturers still put manual overrides in aircraft systems so the pilot can serve as a kind of universal back-stop system. He said one of the anticipated failures occurs in a substantial percentage of military missions.

Crossfield disagrees with the opinion that the art of airmanship should be taken over by "black boxes," leaving the pilot free to serve as a tactical decision-maker. The reaction time of a trained pilot is shorter than that of a computer-controlled servo loop especially where a selection of alternatives is involved. Crossfield also opposes "Red Light, Green Light, Idiot's Delight" instrumentation on the ground that few flight situations can be boiled down to a go, no-go decision.

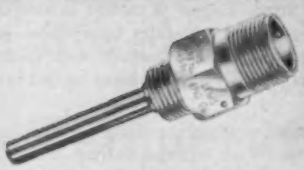
He called for instruments that de-

scribe the problem so the pilot can choose from alternative solutions. He may be obliged to choose the lesser of two evils and a go, no-go presentation is not much help in evaluating them, according to the speaker.

Gen. Flickinger said that the manned weapon system offers tactical and strategic advantages of mobility and combat readiness which are lacking in unmanned missiles. A recoverable manned system is its own pre-launch transportation and can be redeployed quickly and easily to confront the enemy with a high-stake shell game. The fact that it is reusable makes it possible to exercise the system continually and score the reliability of all its parts. To score an unmanned system with equal validity would be uneconomical because of the high expenditure of one-shot systems, he contended. Gen. Flickinger said that two working groups in each of the biomedical and behavorial science fields with representatives from each major USAF research and development agency have been created. He said the groups have been in almost continuous session for six weeks, reorienting USAF's programs in the life sciences toward space flight under the leadership of Col. John Paul Stapp.

STURDY, FAST ACTING RESISTANCE BULBS BY LEWIS

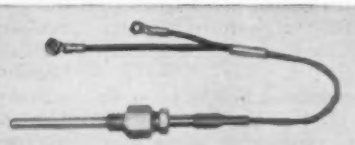
FREE AIR TYPE, MS28038-1 to MIL-B-8598



THREADED, PROBE TYPE MS28034-1 and MS28034-2 to MIL-B-7990

CYLINDER HEAD, BAYONET TYPE AN5546-1 to MIL-B-5491

PROBE TYPE, WITH ADJUSTABLE STAINLESS STEEL STUFFING-GLAND



FOR DEPENDABLE TEMPERATURE MEASUREMENTS, USE LEWIS BULBS WITH LEWIS RESISTANCE THERMOMETERS.

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• MIL-T-6736	• AN-WW-T850a	• MIL-T-6735	• AN-WW-T846

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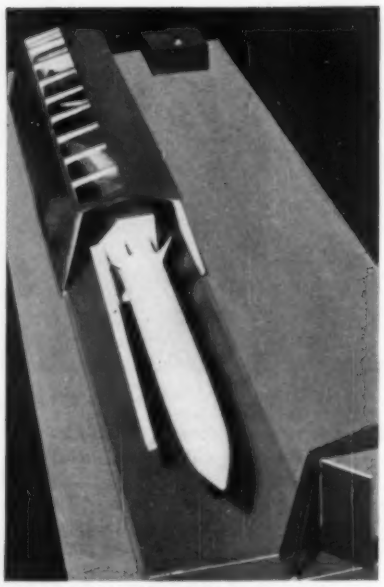

SHELTER for Thor IRBM is portable; will protect missile from weather, winds.

Thor IRBM Hangar Under Construction

San Antonio—Portable shelter for the Douglas Thor IRBM has been designed by the Southwest Research Institute, and prototype shelters are now being built by Missile Engineering Division of Douglas Aircraft Co.

Thor hangar will provide shelter for the intermediate range ballistic missile at its launching site. It will protect the missile from a wide range of hot and cold weather conditions, and it is built to withstand winds up to 120 mph. When Thor is to be fired, an internal power system rolls hangar back from the missile so the weapon can be erected on its firing pad. Detachable front wall of the shelter can be rolled away manually.

The shelter is demountable, and its largest component measures 8 x 15 ft. It is air transportable, as is the Thor missile. Since the Army's Jupiter IRBM is smaller than Thor, the hangar could conceivably be used for that weapon also. Thor hangar was designed by Southwest Research Institute architects under a Douglas contract. Douglas engineers are responsible for developing the actual hardware.

Electroplating Company Studies Thor Nose Cone

Bart Manufacturing Co., Belleville, N. J., electroplating concern, is working on methods of protecting the nose cone of the Air Force Thor intermediate range ballistic missile from friction during re-entry.

ORENDA

IROQUOIS

BENDIX* IGNITION SYSTEMS—FOR THE BEST IN JETS

Another great jet engine has incorporated an ignition system designed and built by Scintilla Division of Bendix Aviation Corporation. Such a system, with the plus features that are a result of years of ignition design experience, is in use on the powerful Iroquois jet engine, product of Orenda Engines Limited, of Malton, Canada.

Selected as the power plant for the Avro Arrow, the Iroquois is a powerful jet engine of very advanced design developing over 20,000 pounds' thrust. Arrangements were recently completed between Orenda and Curtiss-Wright to permit manufacture of the Iroquois engine in the United States.

We are proud that Orenda chose a Bendix-designed jet ignition system for the Iroquois. Serviceability, reliability, and extended overhaul life are inherent features of all jet ignition systems built by Scintilla Division of Bendix Aviation Corporation.

Canadian Affiliate: Aviation Electric Ltd., 200 Laurentien Blvd., Montreal 9, Quebec.

*TRADEMARK

Scintilla Division
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AVIATION CORPORATION

Vought Vocabulary

read′i·ness: *when a fighter as new as tomorrow is in service with the Fleet today*

There's a bright, new glint to our Fleet today.

Chance Vought's 1,000-plus-mph *Crusader* has arrived — in strength! This potent fighter was designed a champion — in speed, ceiling and firepower. It was engineered, too, for swift production and for smooth introduction to pilots.

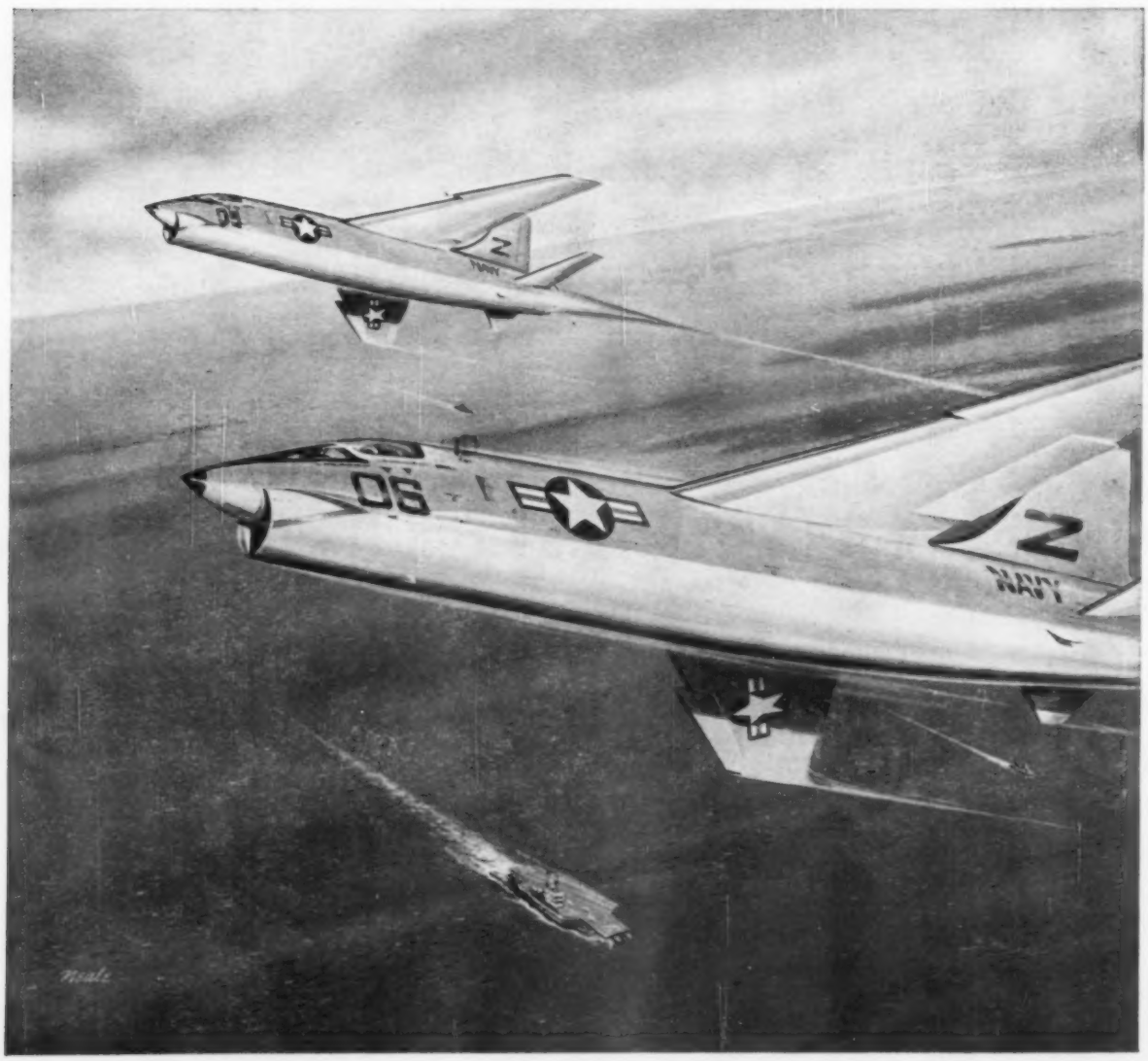
This sped the *Crusader* to duty faster than any modern jet. It brought to the Fleet in an age of peril *a weapon that will hold its edge.*

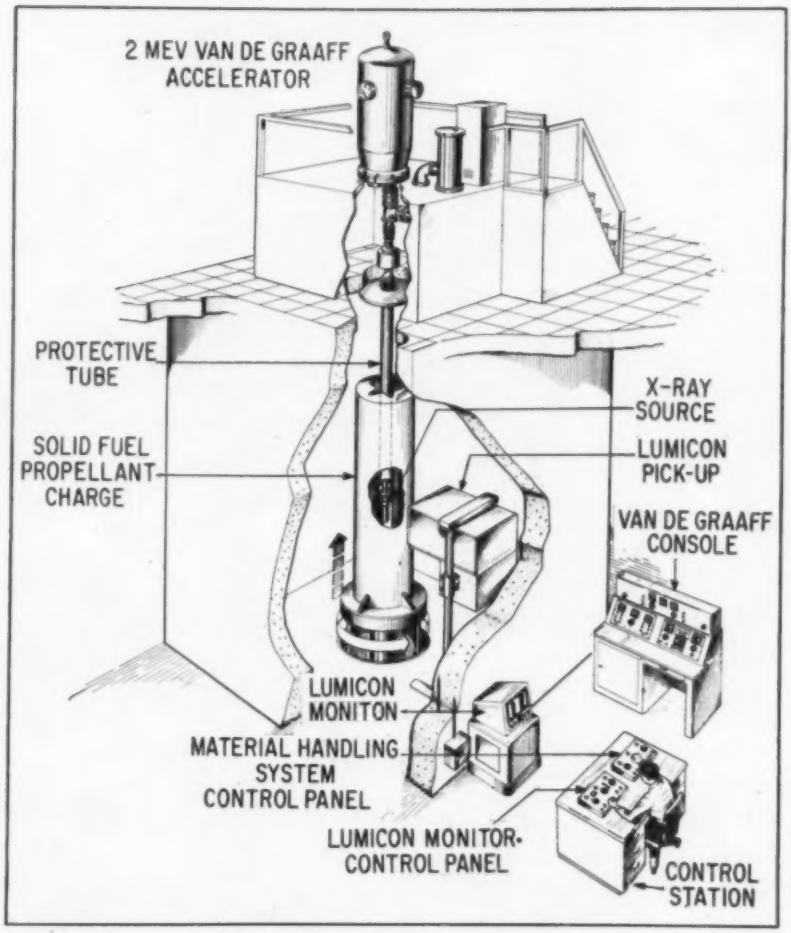
With the *Crusader* comes a new realm of four-figure speeds. Already, Navy and Marine pilots have used its performance to smash major world's records. Their unprecedented supersonic and carrier-to-carrier crossings of the U. S. signal a new chapter in manned aircraft speed and mobility.

Today, squadrons of *Crusaders* sweep the skies above the seas. Their trophy-winning performance adds unmatched combat strength to America's power for peace.

Scientists and engineers: pioneer with Vought in new missile, manned aircraft, and electronics programs. For details on select openings write to: C. A. Besio, Supervisor, Engineering Personnel, Dept. M-3.

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS





X-RAY inspection apparatus for solid fuel rocket engines (above) may allow Thiokol Chemical Corp. to verify homogeneity of 10-ft.-long charge in 15 min.

X-Ray Probe May Eliminate Flaws In Solid Propellant Rocket Fuels

Solid propellant rocket engines with virtually 100% reliability are expected to result from new X-ray inspection equipment being built for the Thiokol Chemical Corp. by High Voltage Engineering Corp. and Bendix Friez.

Careful manufacturing procedures have kept solid fuel engine reliability around 95%, but Thiokol believes X-ray inspection which can detect the slightest flaw in the propellant charge will practically eliminate engine failure.

Flaws in the charge, such as cracks and holes, can suddenly increase burning surface and combustion pressure in the engine and cause a bomb-like explosion.

New inspection setup is shown in the accompanying sketch. A hydraulic lift raises and rotates the solid propellant charge around a "wand" which directs X-ray radiation laterally through the charge. The X-rays are generated by a two-million-volt Van de Graff linear accelerator and are picked up by a Lumicon.

The Lumicon picture is relayed by closed circuit TV to the operator's position. The slightest nonhomogeneity in the charge results in an aberration in the radiation bombardment of the Lumicon and is picked up visually by the operator.

The first X-ray inspection equipment will be installed at the Thiokol plant at Longhorn, Tex., during this month and March. It will be able to handle engines 10 ft. long. The Van de Graff accelerator and "wand" are being built by High Voltage Engineering and the Lumicon by Bendix Friez. Larger equipment is being planned and will be built contingent on the success of the apparatus at Longhorn.

2 X 2 = WHAT?

The simple mathematics of missiles experts sometimes has ordinary people bewildered. The second comrade was purported to have weighed 1100 pounds. Using what has been accepted as a safe rule of thumb - that each payload pound required 1000 pounds of thrust - Sputnik II's rocket power should be 1,100,000 pounds. The experts announced figures variously between 500,000 and 800,000.

More thrust, more fuel. More fuel, more weight. More weight, more thrust. What we need and will get are higher engineering skills; lighter, stronger materials; more powerful propellants.

So long as the shape of things is tubular, formed and welded rings will be used to support or to contain missile engines. Forming and welding rings is King's only business, has been since 1904. For the past several years we've been supplying jet engine manufacturers with high temperature alloy rings at the lowest reject rate in the business.

We believe we have something to contribute to the missiles program. We think we know perhaps a little more than the average small company because of our engineering contacts. Our fortunate size permits us to undertake research programs, turn out pilot orders . . . and we can crank up overnight to handle production runs.

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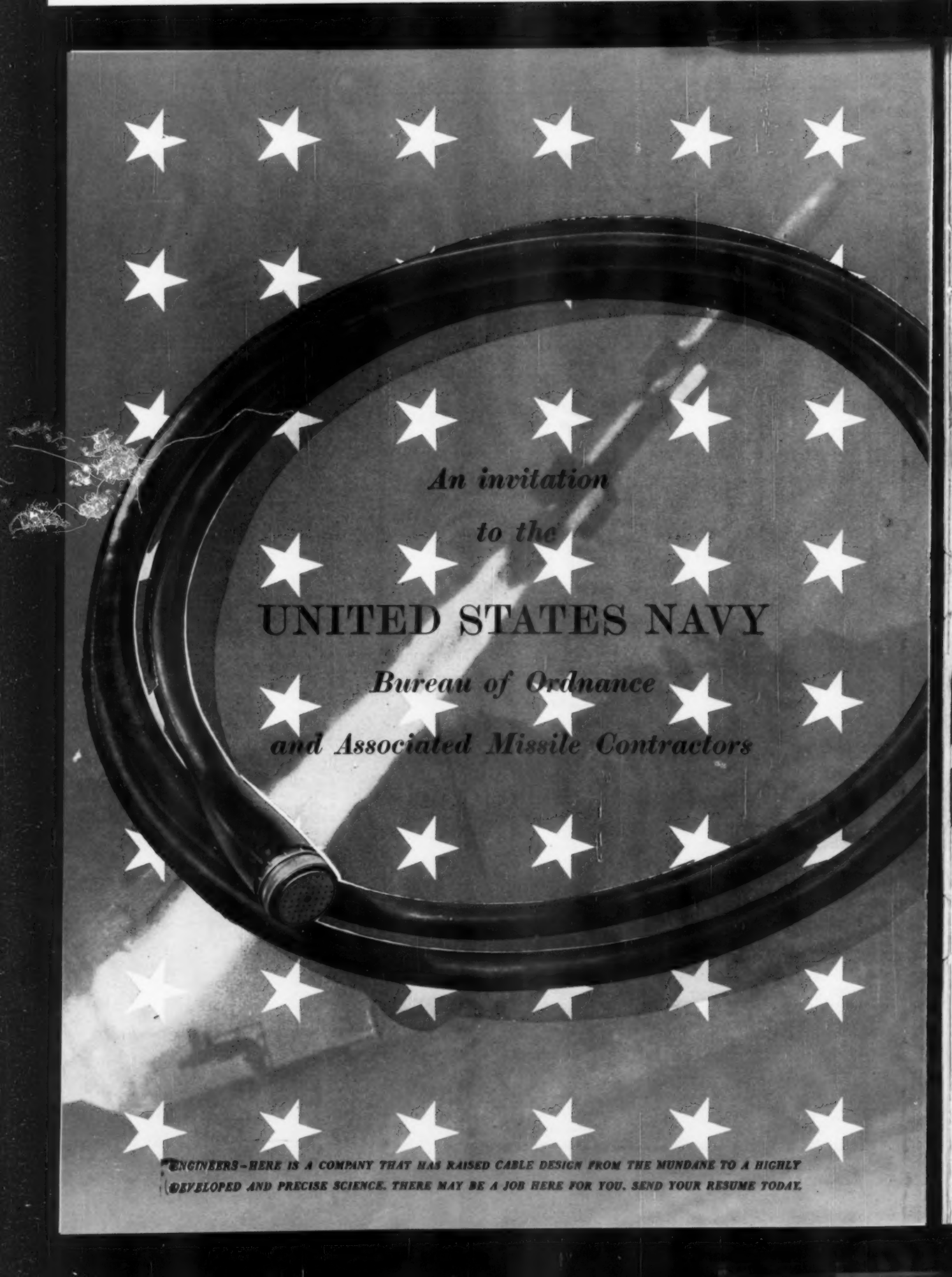
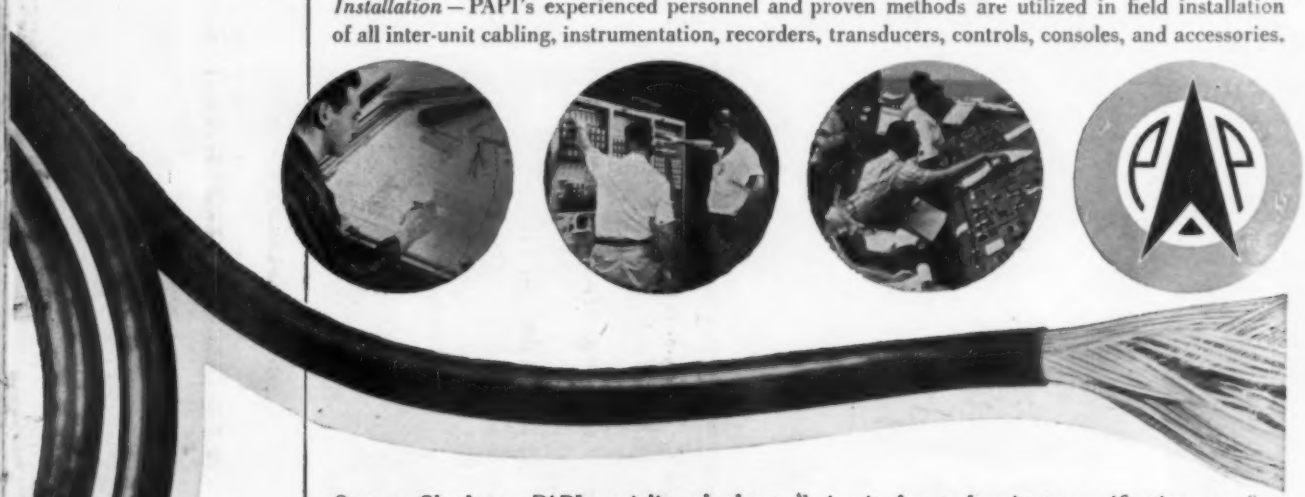

An invitation
to the
UNITED STATES NAVY
Bureau of Ordnance
and Associated Missile Contractors
ENGINEERS—HERE IS A COMPANY THAT HAS RAISED CABLE DESIGN FROM THE MUNDANE TO A HIGHLY
DEVELOPED AND PRECISE SCIENCE. THERE MAY BE A JOB HERE FOR YOU. SEND YOUR RESUME TODAY.

INVITATION: This is an invitation to utilize the missile systems engineering services of Pacific Automation Products, Inc., on current and upcoming Navy missile programs.

SPECIFIC SERVICES: PAPI offers the following services in the cabling and activation of missile test and launch facilities: *Systems Design* — working from schematics, PAPI design engineers will determine every conductor that is needed to link block houses, control centers, terminal rooms, and stands or platforms. Cables are designed to effectively accommodate these conductors, and include break outs, connectors, and accessories. *Systems Fabrication* — cable assemblies leave our plant in ready-to-install condition, with rigorous quality control procedures governing every step of the fabrication process. *Systems Installation* — PAPI's experienced personnel and proven methods are utilized in field installation of all inter-unit cabling, instrumentation, recorders, transducers, controls, consoles, and accessories.



Systems Checkout — PAPI specialists checkout all circuits for conformity to specifications, confirm the operation of each instrumentation system, and validate the fire and launch control functions. *Systems Documentation* — working drawings of the entire installation are supplied in approved form.

QUALIFICATIONS: PAPI is an efficient organization of 600 persons. 130,000 square feet of floor space house engineering and production capacity to meet any workload. Because PAPI cable components have been used in Navy projects, including Vanguard and the Regulus missiles, you know our product to be reliable.

PAPI systems engineering services have been used on other missile programs with these results:

- All sites and facilities are being completed on or ahead of schedule.
- 16,000 cable components are now in service, with no malfunctions due to cabling.
- Costs have been far less than predicted.
- Superior designs and simplified operational characteristics have marked each facility.

Of special interest will be PAPI's Water Tight cable, which salt water cannot penetrate at 500 fathoms. It is ideal for underwater umbilicals.

Because the mechanical and environmental capabilities of PAPI cables often permit great simplification in the design of missile facilities and savings in cost, an early visit by PAPI with site or facility builders is recommended.

CONCLUSION: PAPI's engineering staff includes men with outstanding experience in every phase of the missile business. It is no accident, therefore, that we are the "take charge" sort of people who can take full responsibility for providing the services described in this message. We hope that you will accept this invitation and plan to utilize PAPI's great practical knowledge and experience in missile facility cabling and activation.

Arthur P. Jacob

ARTHUR P. JACOB, EXECUTIVE VICE PRESIDENT

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On Northwest Orient Airlines' overseas flights to Hawaii, Alaska, and the Orient, as well as on coast-to-coast non-stop flights, NWA's DC-7C's, Stratocruisers, and DC-6B's fly long distances where accurate, trustworthy navigating equipment and constant radio contact are essentials. General Electric 5-Star Tubes have helped make possible Northwest's fine record of overwater and domestic schedule maintenance.

DONALD J. LISOR, Mechanical Supervisor, Northwest Orient Airlines, SAYS:

"G-E 5-Star Tubes mean added dependability on our long trans-Pacific flights!"

"More reliable tube performance . . . General Electric 5-Star Tubes give us that from the time we install them. In the picture, I show the sandpaper we formerly had to use to scrub oxidation off tube pins before we plugged the tubes in.

"G-E 5-Star Tubes, on the other hand, come to us with the pins carefully pre-cleaned at the factory. This gives firm, lasting electrical contacts. It's a detail, but an important one in the performance of communications, navigating, and radar equipment.

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"We look on these tubes as a proved investment in greater dependability, lower maintenance costs."

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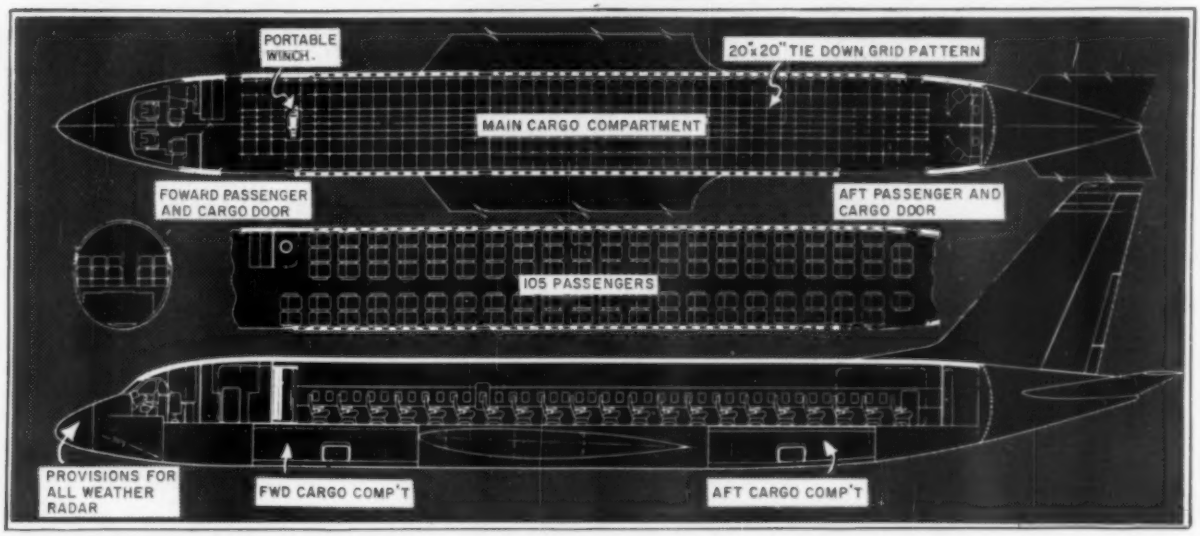

REARWARD passenger seating in military version of Convair 880 jet transport (lower sketch) provides room for 105 persons seated five across. Top sketch shows 880 as an all-cargo aircraft equipped with forward and aft cargo doors to permit simultaneous loading.

Convair Proposes Military Uses for 880

San Diego, Calif.—Designers of the Convair 880 jet transport are considering military adaptations ranging from an electronic countermeasures trainer to an aerial refueling tanker.

For military purposes, the swept wing jet would be powered by four General Electric X207 engines, instead of General Electric CJ-805-3 (J79) engines planned for commercial use, designers said.

Military uses of the 880, which will soon go into production, include these projected designs:

- **Present commercial** configuration, designed to carry 84 passengers in first class arrangement, or 109 in coach seating.
- **Air command** staff and special air mission airplane, a modified version of commercial plane.
- **Cargo-personnel** transport through installation of a 250 psf. cargo floor and two large cargo doors. As personnel transport, aircraft can haul 105 passengers seated five across, or 127 seated six across. All seats face rear.
- **Air evacuation** transport by modifying to install 56 litters, an iron lung and power pack. Large loading doors are at both ends of main compartment, to facilitate use of lifts.
- **Crew trainer** capable of training four B-58 Hustler three-man crews at the same time. Student pilots can fly airplane at full-scale operation stations, with provisions made for override control by the basic air crew.
- **Electronic countermeasures** trainer capable of training 15 students in three groups. Radome is installed in forward lower airframe.
- **Navigator-radar-bombardier** trainer using flexible stations and equipment similar to that used in present tactical bombers and transports in high speed operations.
- **Refueler-tanker** to allow simultaneous refueling of two high-speed aircraft from a probe and drogue type system employing a reel and drum mechanism in wingtip pods. Remote control system incorporates television cameras.

Convair 880, termed Model 22, cruises at 527 kt. for short and medium range passenger service and is designed to permit use of existing airport facilities in all major American cities (AW Oct. 15, p. 57).

Operating Weights

Latest revised basic operating weight is 84,625 lb. Maximum revised gross takeoff weight is 178,500 lb.

Aircraft is overloaded with fuel on ramp to a maximum 180,000 lb. taxi weight, with excess fuel burned off en route to takeoff point.

In modifying present commercial design for command staff use, Convair plans passenger space divisions into functional sections for conference room, office space and communications center. Seats and settees may be converted into sleeping berths. This modification calls for use of the General Electric CJ-805-3 engine.

Computed on a basic operating weight of 87,030 lb. and using zero wind, the command staff modified aircraft could fly from San Francisco, Calif., to Chicago in 3 hr. 40 min., or from Chicago to New York City in 1 hr. 35 min., according to the designers.

Cargo-Personnel Design

Cargo-personnel design places special emphasis on reduction of ground time through use of large doors. Forward door is 78 in. × 104 in. and aft door is 78 in. × 122 in. Two under-floor cargo compartments provide space for smaller items. Standard cargo floor utilizes 20 in. × 20 in. tie-down grids extended through entire cabin area.

Convair says it can quickly rearrange air evacuation transport interior to change ratio of litter and ambulatory patients. Company says pressurization (8,000-ft. cabin at 40,000 ft. altitude, using 8.2 psi.) permits fast flights at altitudes which tend to minimize disturbing effects of weather and gusts.

Model 22 conversion to electronic countermeasures trainer stresses flexibility of stations to allow changes from reconnaissance search (passive electronic countermeasures) to combinations of reconnaissance search and jamming stations (active electronic countermeasures). Convair says provisions can be made for installation of all necessary antennas to cover various operations to minimize aerodynamic drag. Mounting allows for easy attachment or removal to suit the training mission, and equipment can be installed on production line or at modification centers.

Installation of wingtip pods and four fuselage fuel tanks converts utility

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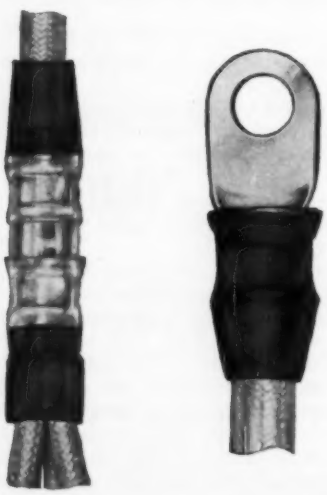

Additional information is available upon request.

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transport into refueling tanker. Tanks are mounted aft of crew stations. Closed circuit television, consisting of three cameras mounted in aft section of airplane, gives refueling operator view of aerial refueling procedures. Each camera has monitor set at operator's station just aft of flight deck.

Additional monitors in cockpit allow pilot and copilot to view refueling operations.

Signal system using multi-colored lights to direct receiving airplane into drogues is installed in lower aft fuselage near television cameras.

Modification provides for 14,680 gal. of fuel in integral wing tanks and an additional 4,000 in the four fuselage tanks.

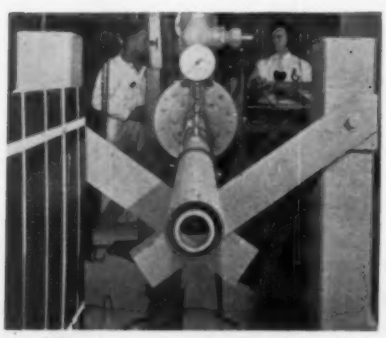
Swiss Buy Hunters, Pay $73.2 Million

Geneva—Swiss government has approved purchase of 100 Hawker Hunter F.6s. Hawker Siddeley Group, Ltd., order is worth $73.2 million. Delivery will start later this year and will be concluded during 1959.

Approval was granted after a long series of evaluation tests of several other foreign aircraft which finally narrowed the choice to the Hunter and the Swiss-built FFA P.16 (AW Sept. 16, p. 65).

Whether a further order for a series of 100 P.16s will be placed as the second stage in the Swiss Air Force's replacement program will be the subject of parliamentary debate in Bern next month.

Export and off-shore orders for the Hunter had reached the $360 million level some time ago. Since then, Hawker received an order from India for about $72 million. With the series of 100 Hunters for the Swiss Air Force, this aircraft will have earned more than half a billion dollars in foreign currency, which makes it Britain's most successful military plane.



Hailstone Blowpipe

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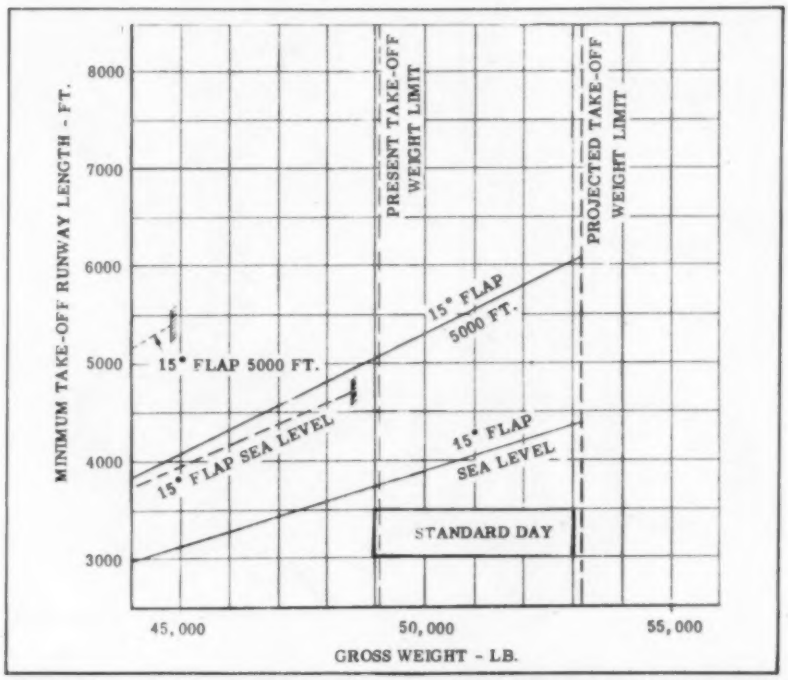

WINGTIP jet takeoff, combined with reciprocating engines, is shown by dotted lines in this chart. Designers claim tip jet can cut field lengths 14 to 25%.

Convair 440 Wingtip Jet Engines Interest Five Overseas Airlines

San Diego, Calif.—Five airlines have indicated interest in a Convair Metropolitan 440 modification which would combine wingtip jet engines with the aircraft's twin Pratt & Whitney R2800-CB17 conventional powerplants.

Convair officials said interested airlines are Sabena Belgian World Airlines, Swissair, Avensa (Venezuela), Iberia and Aviaco. Latter two are Spanish airlines.

Addition of jet thrust to Metropolitan 440, according to Convair, will provide:

- **Increased block speeds** over short ranges.
- **Reduced takeoff distances** and higher rate of climb.
- **Increased payloads** when operating from high altitude airfields or at high temperatures.

Two Engines Offered

Proposed turbojet engines offered for the modification are the Fairchild FT-101E (version of the J44), and the Continental 352-2, (version of the J69). Both engines now are in military service.

Convair said jets also can be installed on its Model 340 and present production airplanes, as well as those currently in use by airlines.

Company has designed three possible interiors: standard 44-passenger, one for 48 passengers and another for 52. Present basic operating weight of 33,174 lb. goes to 34,965 lb. on 48-passenger design and 35,305 lb. on 52-passenger model.

Quiet Cabin

Engineers said location of turbojets on wingtips make for quiet cabin because maximum sound intensity cone passes completely behind the fuselage.

Design weights are 53,200 lb. for takeoff and 50,670 lb. for landing. In computing takeoff distances, designers found field lengths, using wingtip jets, are reduced about 25% at 49,100 lb. and 14% at maximum takeoff weight. Required takeoff length is based on one reciprocating engine failing at critical speed.

Half-temperature accountability on both reciprocating and jet engines is used for hot day takeoff field lengths. If full temperature accountability is required, designers point out that field lengths will increase.

Using maximum jet power rating, the Metropolitan 440 will meet the four-engine en route climb requirement (one engine of four out) at all altitudes up to 6,000 ft. with the J44, and up to

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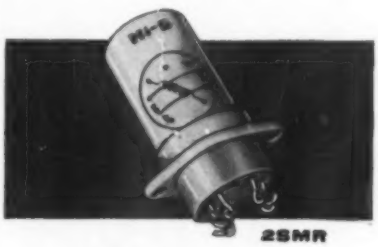

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Gazelle Jr. Repowered

Shaft horsepower of Gazelle Junior free turbine engine will be hiked from 920 shp. to 1,070 shp. after short development period, according to Napier Engines, Inc.

3,000 ft. with the J69 engines. Figures are based on maximum takeoff weight.

Modified Metropolitan 440, using maximum continuous power on reciprocating engines and normal rating on the J44 tip jets, can climb out 96 mi. in 26.5 min. at 1,450 bhp. Addition of J69s can produce 90 mi. climb in 27.5 min.

On long range cruise, turbojets are shut down when gross weight is reduced to 49,200-49,500 lb., depending on altitude. Cruise then is continued at maximum cruise power on reciprocating engines. Below these weights, jet thrust is not required for either emergency approach or clearing 5,000 ft. terrain with one reciprocating engine inoperative.

Landing on a standard day at sea level, field length at maximum weight is about 4,400 ft. Designers say there are no restrictions on use of full flap for takeoff and landing below the 5,000 ft. altitude.

Engine Installation

Convair says tip jet installation is "simple as possible without sacrificing aerodynamic efficiency or impairing maintenance." Engines are mounted in conventional three-point arrangement from a saddle-shaped portion of the upper nacelle structure which is permanently attached to the wing tip. Rest of nacelle is supported from engine and can be lowered to ground dolly as unit with the engine, to allow rapid nacelle change.

Nacelle's aft portion is constructed of stainless steel to prevent fire damage to wing and engine mounts. Forward part of nacelle and inlet duct is made of aluminum alloy. Fire detection and extinguishing system provisions will be made.

Wing modification consists of strengthening portion of spar box with heavier gage material in spar webs and skins, and spar rail reinforcement. New wing tip integral with engine mount structure is substituted. Fuel tank is extended outboard and capacity increased to 2,000 gal.

Separate fuel system is added for turbojets, with fuel drawn from inboard ends of main tanks. Booster pumps are added at inboard end of each tank.

Jets have separate oil systems. J44 uses a non-recoverable oil spray type which does not require an oil cooler. J69 has separate oil tank and requires small amount of oil cooling. Oil tanks for reciprocating engines must be enlarged due to increased fuel capacity.

Windmill Prevention

Since turbojets may be inoperative during part of flight, engineers have designed method of preventing windmill drag. System utilizes two inlet shutoff doors pivoted from a vertical strut. Doors rotate 45 deg. on each side to close off inlet, thus forming a "chisel-

NEW *concepts* IN CONTROL PERFORMANCE

Breaking the sonic barrier required radical departure from many conventional designs and techniques. Efforts to conquer the mysteries of the thermal barrier will call for even more advances in materials, instruments and concepts.

Aerotec engineers have learned to take a long, hard look at the most fanciful ideas . . . for some of these ideas have been developed into instruments and controls that are helping make possible faster and safer flight . . . as well as helping to advance the nation's missile program.

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Heintz Achieves Volume Production with New Sciaky Counter Control Welders

In fabricating and job shops, where a wide variety of assemblies must be welded to rigid specifications every day, Sciaky resistance welding helps keep production schedules *on schedule*.

The Jet Engine Division of the Heintz Division, Kelsey-Hayes Company, a large Philadelphia contract fabricator, manufactures original and replacement parts for the aircraft industry. This means their production must meet exacting jet engine specifications.

New Sciaky Counter Control

To help meet these requirements, Heintz now uses Sciaky Patented Three-Phase Resistance Welders with the new Predetermined Electronic Counter Control. This new unit provides precise control of all welder functions for absolute production consistency. All control settings are realized with extreme accuracy, and are readily reproduced at any time to duplicate previous production runs. The machine cannot deviate from its setting.

Fig. 1 Seam welding Nimonic to Nimonic on Pratt & Whitney Aircraft J-57 afterburner diffuser section.

Fig. 2 Seam welding stainless to stainless on Pratt & Whitney Aircraft J-57 jet engine transition duct assembly. Note simple fixture used.

The Sciaky Predetermined Electronic Counter Weld Control is the only control of this type that has been proved in service, and the first unit of this kind has now been in use nearly two years.

How It Works

The Sciaky Predetermined Electronic Counter Control counts the cycles of power line frequency which is governed by the U.S. Naval Observatory. In predetermined absolute numbers, cycles and impulses are simply counted by a Dekatron tube to control the duration of the various welder functions. The absolute consistency of the control eliminates the need for time-consuming periodical check-out or calibration. Plug-in feature permits easy unit replacement, or addition of other control functions if required.

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Photos show typical Sciaky resistance welding applications on jet engine parts—Afterburners, Screech Screens, Engine Duct Assemblies, etc. Materials welded include Nickel Alloy, Nimonic and Stainless Steel.

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Case histories outlining the successful use of Sciaky Resistance Welding Techniques on jet engine components are available on request. Specific recommendations will be furnished on receipt of an outline of your requirements.

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edged," nacelle nose, preventing ice buildup.

Shutoff doors, inlet lips and center strut are de-iced by pneumatic boots, all actuated simultaneously. Jet engines will have their own anti-icing systems.

Cockpit modifications include throttle for each turbojet, added to each side of pedestal between reciprocating engine throttles. Switch panel is added overhead just below existing engine control panel. Group of four small instruments is added just above upper sill. Convair said pilot visibility is "practically unaffected."

Vertol Acquires ARA In Stock, Cash Deal

Morton, Pa.—Directors of Vertol Aircraft Corp. have approved acquisition of Allied Research Associates, Inc., of Boston, in a move to provide Allied Research with production facilities and Vertol with expanded scientific research capability.

Allied Research has been producing limited quantities of a new all-metal vibration isolation mount and a plastic scintillator used for measuring nuclear radiation. Officials said both products hold promise for large-scale military and industrial use.

Lawrence Levy, Allied Research president who has been elected a Vertol director, said affiliation with Vertol will permit Allied Research to concentrate more intensively on basic research and prototype development, while depending upon Vertol for advanced engineering development and production. Levy said there will be no changes in internal management.

Purchase involves exchange of $750,000 in cash and 32,500 shares of Vertol stock in return for all outstanding stock of Allied Research and its affiliated company, ARA Productions, Inc. Transaction is subject to waiving of preemptive rights on the part of Vertol shareholders of record Feb. 6 at a special meeting March 10.

Don R. Berlin, Vertol president, said the move will "broaden the company's scope of interests and lay the groundwork for diversification into allied as well as completely new fields." Vertol has been engaged solely in manufacture of military and commercial helicopters and experimental vertical takeoff aircraft.

Allied Research, formed six years ago, first worked under USAF contract to determine effects of atomic bomb blasts on aircraft structures. Job involved participation in atomic tests at Nevada and Pacific proving grounds. Present contracts include work in fields of aeronautics, physics, chemistry, electronics and meteorology. Net income

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This non-magnetic property of "NO-MAG" cable eliminates instrument interference from cable magnetism.

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GOOD THERMAL CHARACTERISTICS... The thermal expansion characteristics of new "NO-MAG" cable are much closer than those of standard stainless steel or carbon steel cables to the characteristics of aluminum alloys used in aircraft. This greatly simplifies maintaining cable tension under various changes in temperature.

HIGH FATIGUE RESISTANCE . . . Preformed construction and careful processing give new "NO-MAG" cable high fatigue resistance.

HIGH ABRASION RESISTANCE . . . New "NO-MAG" cable shows greater abrasion resistance than standard stainless steel aircraft cables.

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COMPLETE RANGE OF SIZES, CONSTRUCTIONS . . . New "NO-MAG" is furnished in sizes from 1/16" to 1" in all of the standard aircraft cable constructions.

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for fiscal year ended Sept. 30, 1957, was $40,334 on sales of $1,508,102.

In a letter to shareholders, Berlin said acquisition should enable Allied Research to apply some of its scientific capability to design and development of helicopters and VTOL aircraft.

Longer Range Radar Developed for WV-2E

Combination of a new and more powerful radar and an oversize antenna, developed under Navy Bureau of Aeronautics sponsorship for installation on the Lockheed early warning radar intelligence aircraft WV-2E, is expected to:

- **"See" half again** as far as any current aircraft radar.
- **Reduce "sea clutter"** interference appreciably.
- **Provide radar coverage** from sea level to 100,000 ft. altitudes in a single vertical glance at the sky.

The mammoth antenna, enclosed in an ellipsoidal (saucer-shaped) radome measuring more than 30 ft. in diameter and installed atop the WV-2E fuselage, is built by Hughes Aircraft Co.

Lincoln Laboratories was responsible for the basic development of the radar unit. Radar unit, designated the APS-70, is produced by General Electric Co.

PRODUCTION BRIEFING

Rheem Manufacturing Co., Downey, Calif., has developed welded titanium pressure vessels with significant reductions in weight, for use on the ICBM program. Rheem is studying technology of welded pressure vessels in other materials such as aluminum, steel and stainless steel alloys.

Kaman Aircraft Corp., Bloomfield, Conn., said that its new branch plant in Moosup, Conn., is in production turning out helicopter subassemblies for the company's main plant in Bloomfield. Kaman also plans to move its sub-contract operations to Moosup. Kaman is making airborne electronic equipment housings for Raytheon and cockpit canopy parts for McDonnell's F-101.

General Electric Co., Cincinnati, Ohio, announced that it had received a $3,503,376 contract for its J79-3A jet engines. The engines will power the Navy's Regulus II surface-to-surface missiles.

Air Reduction Pacific Co.'s new air liquefaction plant will produce daily more than 75 tons of liquid oxygen, nitrogen and argon. Costing $7,500,000, the new plant will service military, industrial and commercial activities.

HONEST JOHN artillery rocket depends on G-E electric heating blanket (inset) to bring missile to uniform operating temperature before launching.

HONEST JOHN FIRING SHOWS HOW . . .

General Electric Specialty Heating Maintains Propellant Temperature

Successful launch—and flight—of the Honest John depends upon exact propellant temperature at the moment of firing. A General Electric heating and insulating blanket—which shrouds missile from nose to nozzle—provides and maintains that temperature!

Proper operation of many types of land and airborne equipment, especially at low temperatures, often depends on controlled heat in the right places at the right time. Experienced G-E heating engineers, backed by complete facilities, have already solved thermal conditioning problems on applications ranging from complete missiles and airborne systems to tiny test instruments.

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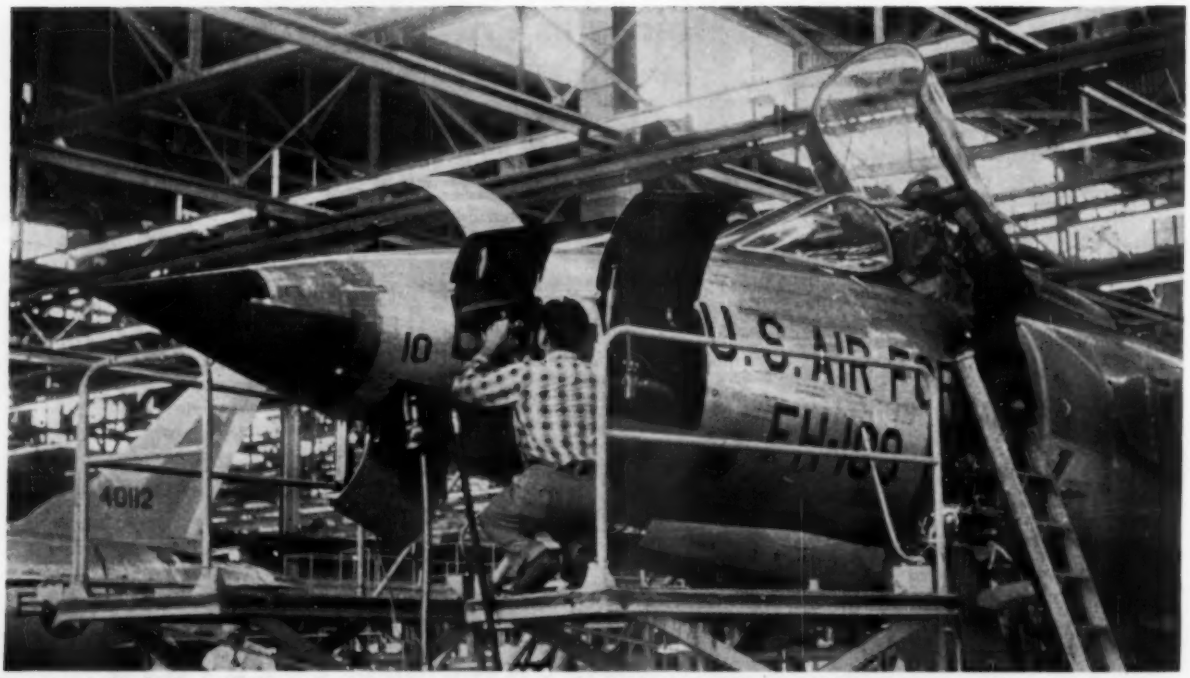
First photograph shows nuclear-weapon-carrying F-105s on final assembly line in Republic Aviation Corp.'s Farmingdale, N. Y., plant.

Republic F-105s Move Down Final Assembly Line



Inspector (left) checks installation of avionics equipment in nose of F-105 at Republic plant. Man at right is working on cockpit.

Main gear is installed (above) in wing of a Republic F-105B. The wing is mounted in a swivel jig for ease of manufacture. Below, three F-105B Thunderchiefs are almost ready to leave the final assembly line in the Farmingdale plant and begin their flight test phase. Tail sections in the foreground will house dive brakes and the afterburner sections of Pratt & Whitney J75 15,000-lb.-thrust turbojet engines. The F-105's cloverleaf speed brakes make up the last 36 in. of the fuselage. Aircraft is equipped with a drag chute. Area-ruled fuselage is 63 ft. 1 in. long; wing span is 34 ft. 11 in. Fighter-bomber has ventral fin on aft fuselage for greater stability.

GYROS with random drift rates as low as 0.05 deg./hr. using modest-cost, non-floated gyros result from new Sperry Rotorace technique in which gyro gimbal bearing races are rotated and periodically reversed to slash bearing friction and average-out torques.

Gyro Drift Cut by Bearing Technique

By Philip J. Klass

Great Neck, N. Y.—Significant development in gyro technology which cuts random drift rate of non-floated gyros by 1,000 to 1,200% and promises even greater future gains has been revealed here by Sperry Gyroscope Co., Division of Sperry Rand Corp.

New technique, called Rotorace, results in modest-cost, non-floated gyros with random drift rates of only 0.25 deg. per hour. Some laboratory models have exhibited drift rates as low as 0.05 deg./hr. under controlled conditions.

Still lower drift rates appear within reach.

Significance of these performance figures is pointed up by fact that 10 years ago a good aircraft gyro had random drift rate of about 10-15 deg./hr., and only recently a rate of 2-3 deg./hr. for non-floated gyros was considered very good.

To achieve the still lower drift rates required for inertial guidance systems, liquid or air flotation has been used to relieve bearing torques which cause drift. However, floated gyros have certain problems. For examples, liquid-floated gyros must be maintained at a relatively fixed temperature to assure constant liquid damping.

Considering the great effort ordinarily required to squeeze small improvements out of gyro performance, the order-of-magnitude gain achieved by Sperry is the more notable because of the relatively simple, low-cost technique employed.

Bearing Technique

Briefly, it consists of rotating the outer races of two gyro gimbal bearings (not gyro motor bearings) in opposite directions, then reversing the direction of rotation periodically. Hence the name "Rotorace." Small servo motor provides driving power for rotating outer bearing races through associated gearing.

Idea of manipulating gyro bearings to minimize friction and drift is not itself new.

One European patent, now expired, covers contrarotation of gimbal bearings. Another approach, long used with shipboard gyros, is to rotate the entire gimbal about the spinning gyro. Another expired European patent covers oscillating of gyro gimbal bearing race through a small angle, but not through many complete revolutions as in Rotorace.

To understand why so simple a technique provides such significant gains in gyro performance it is necessary to look at a major source of unpredictable gyro error—usually called random drift. Infinitesimal differences in the size of the tiny ball bearings used in gyro supporting gimbals, slight out-of-roundness, the smallest ellipticity in the bearing races or a particle of dirt only a few microns thick can produce miniscule torques which will cause gyro spin axis to precess (drift) away from the desired fixed position in space.

Stray Torque

Even if it were feasible to measure or determine these potential sources of stray torque during manufacture, it would be impossible to predict exactly how, when or in what direction they would act. For example, a slightly irregular ball might end up anywhere around the bearing race which makes it impossible to predict in what direction

its torques will be applied—hence in what direction gyro will drift.

If, however, the outer bearing race is rotated through at least several complete revolutions, first in one direction and then in the opposite, these unpredictable torques will be briefly applied around the circumference of the gyro gimbal axis shaft with a resultant cancellation of random drift over a period of several rotation cycles.

Drift Error

This same sort of cancellation can take place in a conventional gyro—and frequently does—over a period of several hours, but the important value is the drift error at any instant and this can be quite high. With Rotorace, this averaging is greatly accelerated so that these random drift errors are averaged out over a period of several seconds instead of several hours.

Speed of bearing race rotation is not critical in terms of absolute time or number of revolutions. Only requirement is that the total rotation time (or number of revolutions) in one direction be equal to that in the opposite direction. Current models operate with a bearing race rotational speed of about 20 rpm. Small cam-actuated switch, operated by Rotorace motor, reverses rotation in a regular cycle.

In addition, to minimizing random drift due to geometric irregularities in the bearing, rotation of the bearing race also reduces static (breakaway) friction —another cause of gyro drift.

Still another byproduct advantage is the fact that pitting or wear caused by shock and vibration is equally distributed among all the balls in a bearing, instead of one or two. This prevents build-up of still further irregularity between individual balls in service use.

Effectiveness of several techniques for reducing random gyro drift rate is indicated below for a non-floated gyro whose normal drift rate is about ±3 deg./hr. when operated on an oscillating Scorsby test stand. Random drift rate of such a gyro can be reduced to:

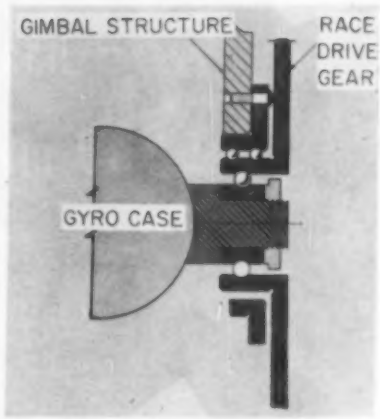
- **±1 deg./hr.** by oscillating outer race of gimbal bearings back and forth over roughly a ±30 deg. amplitude.
- **±0.8 deg./hr.** by continuously rotating two gimbal bearings in opposite direction.
- **±0.25 deg./hr.** by counter-rotation of gimbal bearings and periodic reversal of direction so that total rotation in each direction is approximately equal. This is the Sperry Rotorace technique.

Special Bearings

Application of the Rotorace technique required the development of a special gimbal bearing designed to permit rotation of its outer race—normally fixed to the gimbal supporting structure. Needed was a concentric pair of bearings in which the inner bearing's outer race is the outer bearing's inner race.

Original development of the Rotorace bearing was carried out by Sperry. Company then went to New Departure Division of General Motors Corp. which worked out the techniques of assembling the concentric bearings to the required precision.

Present cost of the Rotorace bearings is about $25, roughly 10 times the cost of a bearing in a conventional gyro, according to Arthur Lane, Engineering Department head for attitude and azimuth reference systems. As production quantities go up, Lane says that bearing costs are certain to come down.



ROTORACE bearing consists of two concentric bearings, with outer race of one serving as inner race of the other.

However, the added cost of the special bearings, and the small two-phase servo motor and associated gearing required to drive them, is a small percentage of total gyro cost and a small price to pay for a 1,200% gain in performance, Lane points out. It is far less costly than trying to achieve the same drift rates by trying to squeeze down still further on dimensional control of gyro parts, Lane believes. Rotorace technique does not pay off fully unless gyro wheel has a relatively low mass shift, but this presents no problems with existing techniques, according to Lane.

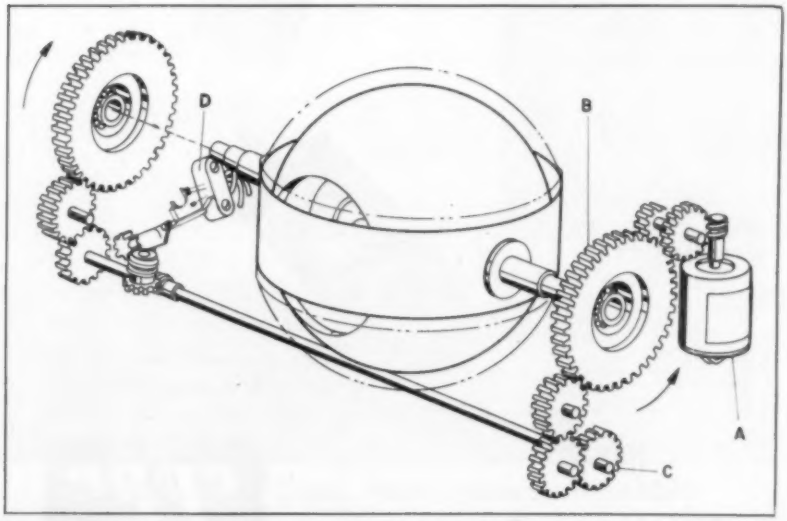
In Airline Service

Another interesting aspect of the Rotorace principle is the fact that within a year after its discovery Sperry had experimental gyros in airline service and was in production the following year. Experimental units have been in use on Pan American World Airways Inc., and Scandinavian Airways System Inc., Douglas DC-7Cs for polar and trans-ocean routes and a third unit is slated soon for installation on a KLM Royal Dutch Airlines airplane.

Sperry says it did not tell the airlines about the new technique employed, merely assured them that the gyros would have drift of less than one degree per hour. Sperry tipped its hand on the Rotorace principle only to SAS after the airline appeared reluctant to use a gyro with such low drift rates for fear there would be maintenance and reliability problems.

The experimental gyros did encounter minor bugs—but not with the Rotorace feature. One was a seizure of a non-Rotorace gyro wheel bearing; another was failure of a power converter.

Sperry C-11 Rotorace gyro-compass systems, with free-gyro drift rates of 0.25 deg./hr., will be used on all trans-ocean, trans-polar DC-8 jetliners and on many of the Boeing 707s employed in



ROTORACE technique employs small motor (A) to rotate outer race of gyro gimbal bearing (B), while opposite gimbal bearing is rotated in reverse direction via gear train (C). Periodic reversal of both bearing rotations is accomplished by worm-driven switch (D).

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TYPICAL SYSTEM MEASUREMENTS

	Input Voltage (Volts)	Input Current (Amps.)	Input Power (Watts)	Output Voltage (Volts)	Sensitivity (MV/deg.)	IMPEDANCE Input	IMPEDANCE Output	Phase Shift (deg.)	Remarks
Transmitter -Control Transformer	26	.111	.74	22.5	885	58+j226	828+j232	19	High impedance load on CT
Transmitter -Control Transformer	26	.111	.75	21.6	377	58+j226		19	50° load on CT
Transmitter -Control Transformer	26	.110	.82	10.2	355	84+j221		17	5° load on CT
Transmitter -Differential -CT	26	.134	1.70	18.5	340		748+j884	40	Output to high impedance
Electrical Resolver -Electrical Resolver	11.8	.115		7	120			32	Input to stator
Electrical Resolver -Electrical Resolver	26			15	280			32	Input to rotor

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LOOK TO cppc FOR SYNCHRO PROGRESS

ROTORACE bearing is being produced by New Departure which worked out difficult manufacturing techniques needed.

international service, Sperry says.

Rotorace gyros also are in production for use in a compact, lightweight twin-gyro stabilized platform that Sperry is building for the Air Force (AW Oct. 28, p. 101). This novel platform uses one two-axis gyro for azimuth and roll-axis reference, the other for azimuth and pitch-axis reference. Azimuth spin axes of the two gyros are maintained 90 deg. apart and coupled so that combined drift of the two gyros can never be more than that of one gyro and in some cases is considerably less than the random drift of either.

Drift rates of 0.25 deg./hr. which Sperry is quoting for its C-11 airline gyro is "only the beginning," according to P. Halpert, chief engineer of company's Aeronautical Equipment Division. "We are just on the threshhold of major gains in gyro accuracy," Halpert predicts.

Sperry now is conducting fundamental investigations into other sources of gyro error which previously appeared relatively minor but which now loom large as a result of gains achieved by Rotorace technique.

Expansions, Changes In Avionics Industry

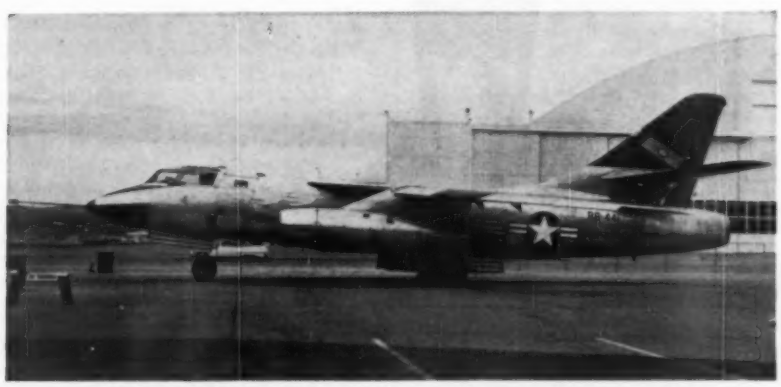
Summers Gyroscope Co., Santa Monica, Calif., will merge with Mercast Corp. of Los Angeles, an affiliate of Atlas Corporation which owns about 43 per cent of its stock, to become Summers Corporation, providing stockholders, Civil Aeronautics Board and California Commissioner of Corporations approves. (CAB approval is needed because of Atlas Corporation's interest in Northeast Airlines.) Mercast official Jack S. Warshauer becomes executive vice president and chief executive officer of Summers Gyroscope which will be one of three divisions of new firm. Other two divisions are Mercast Corp. and Gray & Huleguard, former Mercast subsidiary. Tom Summers remains as president, but will devote efforts primarily to research and development.

Other recently announced changes, expansions in the avionics field include:

• **Dynavia Engineering Corp.,** is now firm, headed by Robert Haskins, which will develop and manufacture instruments and controls for commercial aviation use. Company is located at 860 Fabian Way, Palo Alto, Calif.

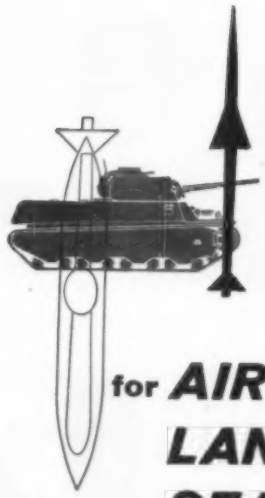
• **Digitran Co.,** Pasadena, Calif., is name of new company which formerly was known as Anatran division of Endevco Corp. New company will develop and produce electrical read-out counters and digital motors. Company address: 45 West Union St.

• **Consolidated Electrodynamics Corp.,** Pasadena and Cenco Instruments Corp., Chicago, will merge if stockholders approve. Both companies are developers and producers of instruments; CEC has concentrated in the data processing field



JRB-66 Tail Cone Now Interchangeable

Douglas JRB-66 combat mission capability was broadened when aircraft was modified with readily interchangeable tail cones. Cone on aircraft shown above at Edwards AFB contains electronic equipment. Original cone was fitted with two 20 mm. cannon in a tail ball-turret. Plane is designed to carry considerable photographic equipment.



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Servo Leads In Producing Infrared Weapons Systems

It may be the detection system that picks out a hostile submarine sneaking in under fog or dark. Or it could be the infrared gun flash detector that spots enemy artillery placement no matter how well camouflaged. It might be a missile interceptor, with its infrared terminal guidance locking ever tighter on the cornered victim as evasive action or speed is increased.

But *wherever* you run across infrared systems in ordnance and other military equipment, you are most probably finding more Servo Corporation apparatus. For Servo Corporation of America has developed *more infrared systems for weapons use* than any one else in the world. Since executing the first infrared guidance contract in 1947 for the Navy, Servo has been the pioneer in infrared development, leading in all phases of designing and producing infrared equipment. In supplying standard infrared lenses, detector cells, or other components to assemblers or other manufacturers, and in designing and building complete IR reconnaissance or guidance systems for integration into modern military mechanisms, the first thought in infrared becomes SERVO.

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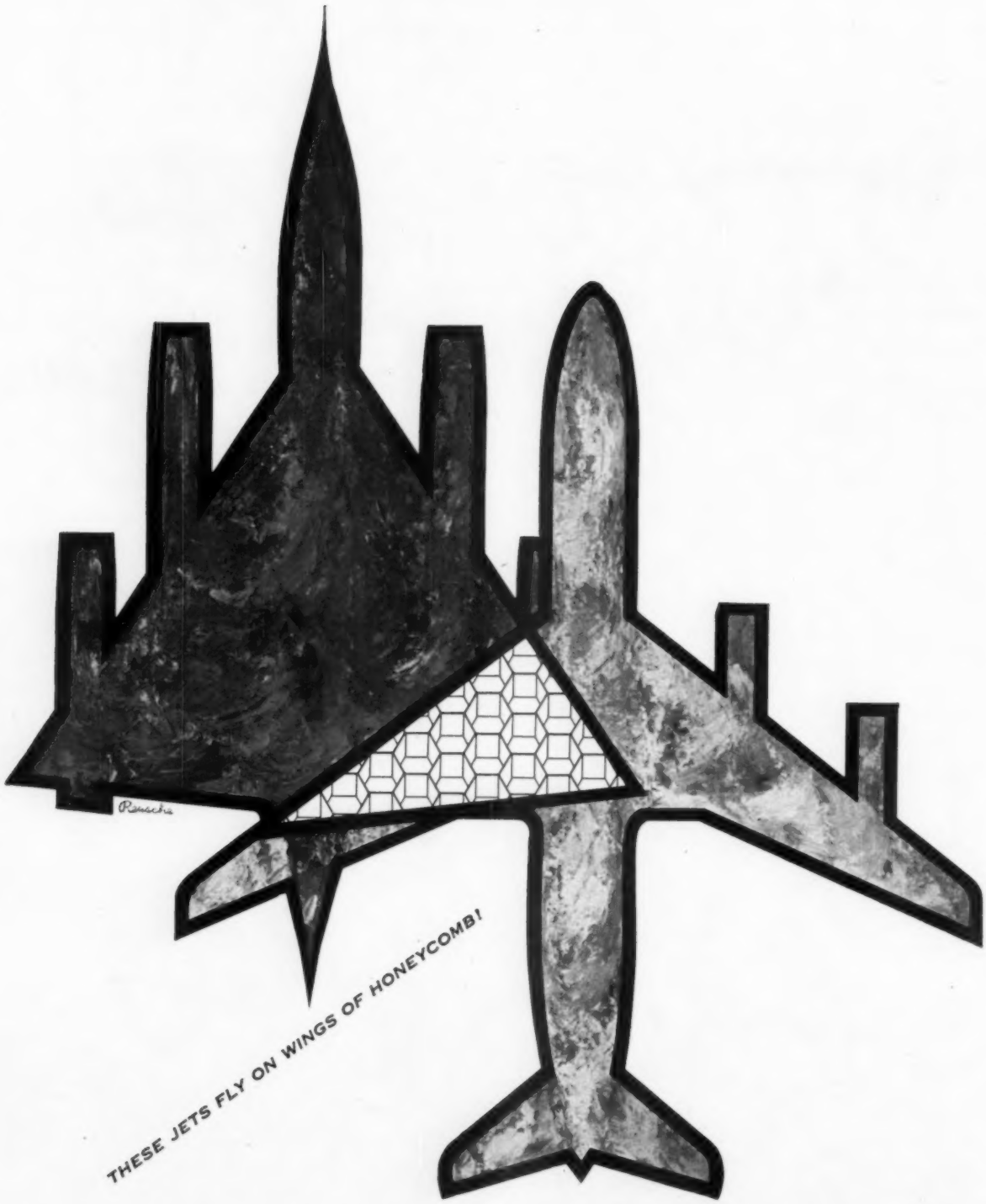

The use of Hexcel® Honeycomb in Supersonic military planes like the B-58 Hustler is a familiar practice with Convair. And when Convair's new "880" jet transport takes to the air in regular passenger service it, too, will fly on wings of Honeycomb—Convair's first use of this material for primary structures in commercial aircraft. Great strength, light weight, high rigidity and remarkable resistance to acoustical bombardment are just a few of the reasons why more and more Hexcel Honeycomb is being used by leading airframe manufacturers here and abroad.

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while Cenco has concentrated on scientific-laboratory type instruments.

• **The Singer Manufacturing Co.,** Elizabeth, N. J., sewing machine manufacturer, has purchased Haller, Raymond & Brown from Topp Industries, Inc., Beverly Hills, Calif., which acquired the company last year. New acquisition will operate as division of Singer, maintaining its corporate identity. No change in officers or personnel is contemplated.

• **American Machine & Foundry Co.** will close its Boston electronics plant, reassign its work to AMF's Greenwich, Conn., and Pomona, Calif. facilities. Dr. Wendell B. Sell, former general manager at Boston, becomes divisional vice president with headquarters in Pomona.

Texas Instruments To Build CAA Radars

Dallas—Civil Aeronautics Administration contract for an improved type of airport surveillance radar has been won by Texas Instruments Inc.

Under the $4,691,884 contract, delivery of the new ASR-4 systems will begin in about two years for installation at 14 U. S. cities.

Texas Instruments ASR-4 will improve approach and departure traffic control by providing altitude coverage between 4,000 and 27,000 ft. while on the 30-mi. range. This is a gain of 4,000 ft. in altitude coverage over previous ASR models used by CAA.

ASR-4 will have a built-in circular polarization that will enable the system to pick up aircraft during rain and snow weather conditions which normally render radars without this feature practically useless. It also will have an improved moving target indicator that will cancel out all but moving targets on the display.

Antenna system for the new surveillance radar will be built to stand wind velocities of up to 85 kt. while burdened with an inch and a half of ice. Provisions will be made to mount a 30 ft. secondary radar antenna when such equipment is available.

Continuous monitoring of power output and equipment sensitivity will be possible with ASR-4. Each set will have four 16-in. indicators, three for operational use and one for stand-by purposes.

Cities scheduled to get the systems when they become available are: Albany, N. Y.; Ft. Wayne, Ind.; Akron, Ohio; Burlington, Vt.; Sacramento, Calif.; Charleston, S. C.; Bedford, Mass.; Boise, Idaho; Charlotte, N. C.; Little Rock, Ark.; Youngstown, Ohio; Rochester, N. Y.; Syracuse, N. Y., and Orlando, Fla.

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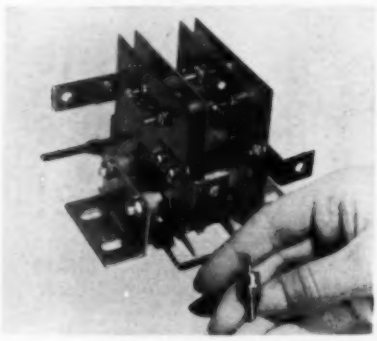
NEW AVIONIC PRODUCTS

(Note: Beginning with this issue, New Avionic Products has added a category called "High Temperature Components," in recognition of the steadily growing importance of this area in avionics. Components listed in this section have, according to their manufacturers, been designed to operate at temperatures above 300F.).

High Temperature Components

• **Silicon power rectifier,** Type 304, is hermetically sealed, can provide forward direct current up to 12 amp. with maximum peak inverse voltage to 500 v. Unit can operate at junction temperature of 380F with no detectable change of characteristics due to aging. Reverse leakage is a maximum of 10



ma. at rated peak inverse voltage and maximum temperature. Case is the positive terminal with ⅜ in. threaded stud permitting mounting in any position.

Complete bridge assemblies are also available. Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

• **Two types of mica insulation,** called Capacitor Grade Isomica and Samica, for use in rolled or stacked capacitors are said to provide void-free mica insulation in unlimited size at a fraction of the cost of imported mica films. Samica is a pure mica sheet made from foreign or domestic mica refined to remove impurities. Highly flexible, it is presently being used in rolled capacitors where the sheet will withstand temperatures up to 1,000F. Isomica sheets consist of Samica base sheets impregnated with a silicone resin to provide optimum dielectric characteristics at continuous operating temperatures to 550F. Sheet thickness as small as 0.0009 in. are available. Mica Insulator Division, Minnesota Mining and Manufacturing Co., Schenectady, N. Y.

• **Encapsulated power transformers,** called Epseal transformers, developed for missile and airborne applications with ambient temperatures up to 350F have been approved under MIL-T-27A Grade 5 Class T Life X specifications. Life is up to 10,000 hr. at 250F ambient, but less at higher temperatures. Details and specifications from Alectro Engineering Works, Inc., 401 Preda St., San Leandro, Calif.

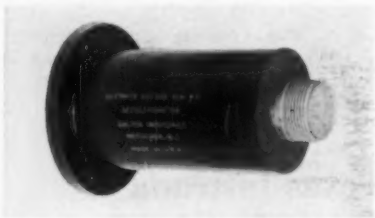
• **Trimmer potentiometer,** called FilmPot, has completed six months test program for use with system to be installed in a nuclear powered aircraft. Unit is able to operate effectively at temperatures as high as 750F, according to the manufacturer. Measuring 2 x ½ x ½ in., FilmPot utilizes a continuous film of evaporated precious metal alloys to obtain resistance stability of better than 5% up to 30K ohms over a temperature range from −65F to +750F. Fairchild Controls Corp., 6111 E. Washington Blvd., Los Angeles, Calif.

Components & Devices

• **Servo motor** has been developed that is small enough to pass through an engagement ring. Measuring ¼ in. diameter by 1⅛ in. length, manufacturer believes it to be the smallest 400 cycle motor available for servo system requiring low inertia for prompt response. Motor consists of a squirrel-cage rotor with a two phase stator in a number 5 frame. Fixed phase and control phase

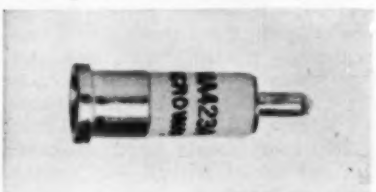
voltage and current are 26 v. and 92 ma. respectively. Operating temperature range is −65 to +158F. Eclipse-Pioneer Division, Bendix Aviation Corp., Teterboro, N. J.

• **Differential transformer accelerometer,** Model ADT-905, is equipped with self-calibrating system which can be used statically or dynamically, also can check operation of the accelerometer while in use. Unit is said to be inherently stable over temperature range of −65 to +250F. Designed primarily for control and guidance in



aircraft and missiles, the unit operates at a low natural frequency of approximately 30 cps., maintaining stable frequency response characteristics over the temperature range as a result of magnetic damping. Gulton Industries, Inc., 212 Durham Ave., Metuchen, N. J.

• **Silicon mixer diode,** Type MA-423A, is for use in C and X-band microwave receiver applications. Mechanically interchangeable with other diodes of the 1N23 series, the point contact unit requires no d.c. bias and is said to provide improved receiver noise figures of



7.0 db. or better when used with a 1.5 db. IF strip at 30 mc. In some radar receivers employing 1N23C or 1N23E diodes, circuit adjustment of IF impedance match, local oscillator drive, and RF match may be necessary to obtain maximum noise figure improvement. Microwave Associates, Inc., Burlington, Mass.

• **Magnetic servo amplifier,** Type CSA-2A-1, is a three-stage amplifier designed to accurately maintain motor shaft position of a two phase 60 cycle induction motor, meets MIL-E-5272C. Full voltage output is provided with an input of 20 microamps d.c., corresponding to a d.c. voltage of 7 mv. Temperature range is −62 to +85C, weight 10 lb., dimensions 6.5 x 7 x 2.75 in. Magnetic Controls Co., 6405 Cambridge St., Minneapolis 16, Minn.

How to keep controls and costs "in line"!

FAFNIR Torque Tube Type Aircraft Control Bearing

with Self-Aligning Outer Ring

Exposed Surfaces Cadmium Plated
Mated Self-Aligning Outer Ring
Full Complement of Balls
Synthetic Seals have Stainless Steel Snap Ring Washers
Uninterrupted Surface Contact with Outer Ring of Bearing
Close Fit between Bearing and Self-Aligning Ring

Design, assembly, and inspection of push-pull control systems are simplified considerably when Fafnir KP-BS Torque Tube Type Control Bearings are specified.

Developed to accommodate structural deflection, manufacturing errors, and differential expansion and contraction in high-speed aircraft, KP-BS bearings feature a self-aligning outer ring. This eliminates the need for extra parts to achieve and maintain correct bearing alignment in housings. Thus these bearings make possible important savings in space, weight, assembly time, and costs.

An adaptation of the AN202 KP-B series, Fafnir Self-Aligning Torque Tube Type Ball Bearings have the same high capacity as the rigid KP-B Type. The close fit between the self-aligning ring and the bearing provides the necessary rigidity for control systems. For detailed specifications, write The Fafnir Bearing Company, New Britain, Conn.

AVAILABLE SIZES AND DIMENSIONS

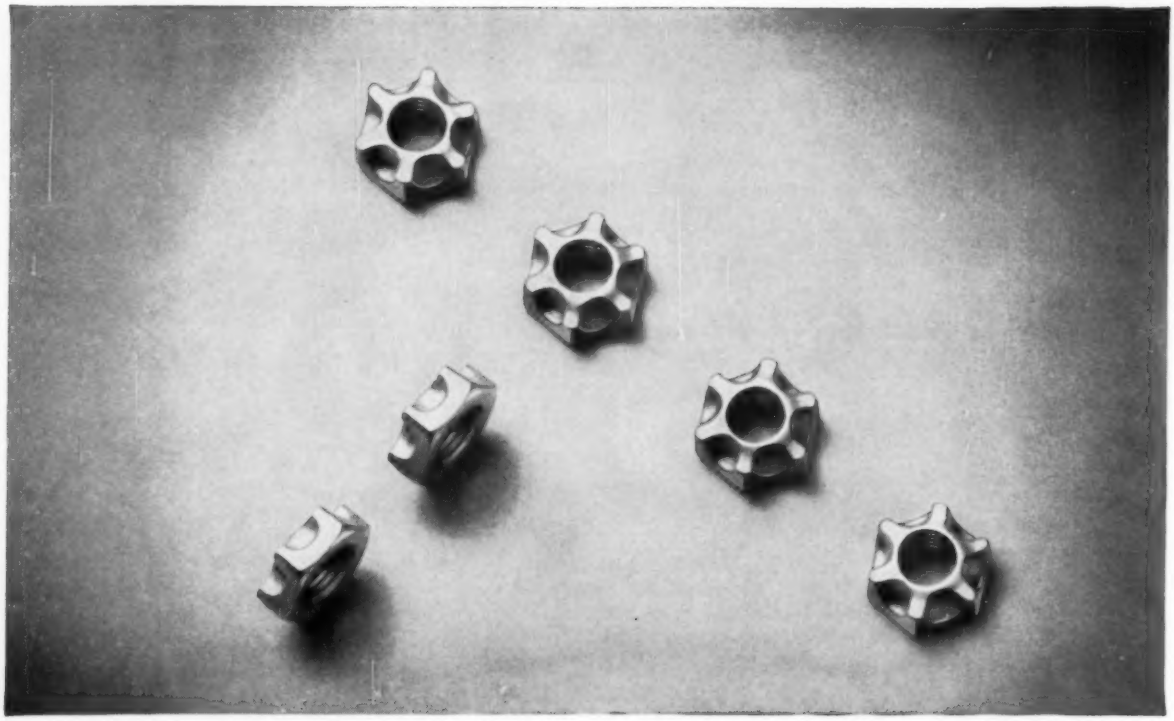
Bearing Number	B	D	W	H	A	E	C	K	Balls		Weight Pounds
	Bore +.0000 −.0010	Outside Diam. +.0000 −.0010	Width Inner Ring +.000 −.005	Width Outer Ring +.000 −.005	Shoulder Diam. Inner Ring (Approx.)	Corner Rad. Cleared: Inner Ring Bore	Corner Rad. Cleared: Outer Ring O.D.	To Corner (Ref.)	No.	Size	Approx.
	Inches	Inches	Inches	Inches	Inches	Inches					
KP16BS	1.0000*	1.9375	.437	.375	1.141	.024	.024	1.709	23	3/16"	.18
KP21BS	1.3130	2.2500	.437	.375	1.454	.024	.024	2.028	28	3/16"	.20
KP23BS	1.4380	2.3750	.437	.375	1.575	.024	.024	2.155	30	3/16"	.22
KP25BS	1.5630	2.5000	.437	.375	1.693	.024	.024	2.282	32	3/16"	.25
KP29BS	1.8130	2.7500	.437	.375	1.931	.024	.024	2.535	36	3/16"	.27
KP33BS	2.0630	3.0000	.437	.375	2.231	.024	.024	2.787	41	3/16"	.30
KP37BS	2.3130	3.2500	.437	.375	2.468	.024	.024	3.039	45	3/16"	.33
KP47BS	2.9380	4.1250	.531	.469	3.093	.039	.039	3.846	45	15/64"	.64
KP49BS	3.0630	4.2500	.531	.469	3.222	.039	.039	3.972	44	1/4"	.69

*+.0000 −.0005

Bearings incorporate Fafnir Flya-Seals and are pre-lubricated at the factory.

FAFNIR AIRCRAFT BEARINGS

FIRST...at the turning points in aircraft design



Distinctive ribs of new SPS self-locking lightweight nuts not only add strength, but also assure good wrenching efficiency, because the full height of the nut is usable wrenching surface. All threads are locking threads.

New SPS lightweight locknuts help you reduce airframe weight without sacrificing strength

Self-locking fasteners are 49% lighter than their standard counterparts

If you are looking for ways to save weight in airframe construction, SPS's new self-locking lightweight nuts offer a solution. Designed specifically to save weight without sacrificing fastening strength, these latest additions to the FLEXLOC line of lock/stop nuts average 49% lighter than their standard counterparts.

Approved under specifications AN-N-10A and MIL-N-25027, SPS lightweight locknuts are of 1-piece, all-metal design, forged for high strength. Threads, which employ 3-point locking action, are all locking threads. This, combined with thinness of the nut, permits use of shorter bolts, resulting in further weight reductions.

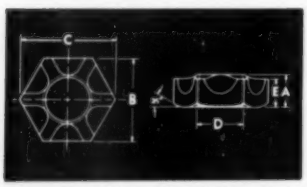
Extensive testing of the new SPS self-locking lightweight nuts under requirements of Government specifications included such procedures as one full hour of vibration testing (for a ¼-28 nut). Results show that the overall design maintains a high degree of reusability, excellent tension-tension fatigue characteristics, and superior holding power under conditions of severe vibration at temperatures up to 550° F.

For complete information, write Aircraft and Missiles Division, STANDARD PRESSED STEEL CO., Jenkintown 3, Pa.

hiRf *High Reliability factor*

At SPS we apply a dynamic standard of quality — continually refined—so that our fasteners will always have the high reliability factor required by today's faster speeds, higher temperatures, and greater dynamic forces. By using SPS fasteners in your assemblies, you increase overall reliability—the certainty of predictable performance under actual service conditions.

For more information on the science of reliability—the newest branch of product engineering—write for a copy of the SPS booklet "Concerning High Reliability"—just published.



PART NUMBER	SIZE	A	B		C	D		E	APPROX LBS.
		MAX	MAX	MIN	MIN	MAX	MIN	MIN	PER 100
22 FZ - 832	8-32 NC - 2	.150	.345	.336	.383	.195	.180	.122	.19
22 FZ - 1032	10-32 NF - 3	.165	.376	.367	.419	.221	.206	.122	.25
22 FZ - 428	1/4-28 NF - 3	.180	.439	.430	.491	.281	.266	.142	.38
22 FZ - 524	5/16-24 NF - 3	.235	.502	.492	.561	.344	.329	.173	.63
22 FZ - 624	3/8-24 NF - 3	.290	.564	.553	.631	.406	.391	.183	.90

New SPS self-locking lightweight nuts, available in five sizes—from #8 through ⅜ in.—are cadmium plated per specification QQ-P-416.

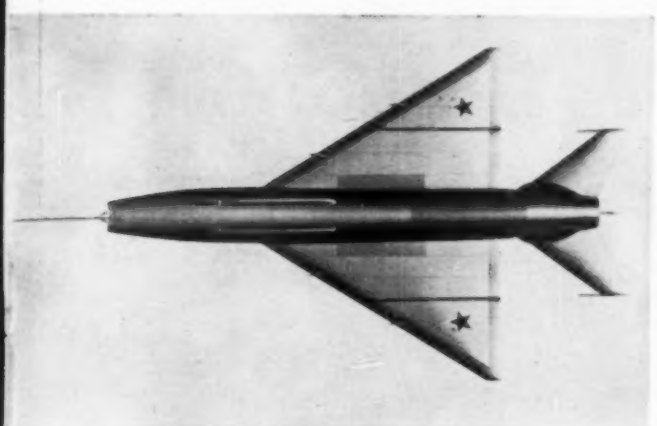
We also manufacture precision titanium fasteners / write for free booklet

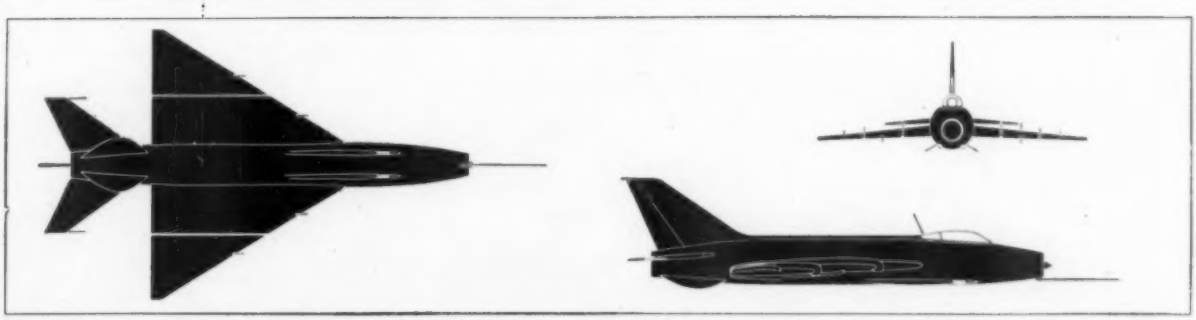
SPS Jenkintown • Pennsylvania

Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co. • National Machine Products Co. • Nutt-Shel Co. • SPS Western • Standco Canada Ltd. • Unbrako Socket Screw Co., Ltd.

Fishbed B Fences, Fins Indicate Airflow Problem

Supersonic Russian fighter designed by Pavel Sukhoi and code-named Fishbed by NATO was observed at the 1956 Tushino air-show. Development of Fishbed B has been discontinued; it has been superseded by the Sukhoi Fishpot (AW Jan. 20, p. 38). Wing fences and ventral fins on Fishbed B—large number of which indicate aerodynamic troubles—have been eliminated on Fishpot. Wing planform and tail arrangement on the two aircraft are nearly identical.





KC-135s on Line at Castle AFB

Combat readiness of USAF's Strategic Air Command is demonstrated by these Boeing KC-135 jet tanker-transports, shown on flight line at Castle AFB, Merced, Calif. Aircraft performs major support role as part of SAC's world-wide deterrent striking force. On operational status with SAC for nearly two years, the KC-135s have multi-purpose as aerial tankers to refuel fighters and bombers at high speeds and altitudes, and as transports for high-priority cargoes and personnel. Civil counterpart is Boeing 707 transport now in CAA test phase.

Researchers Operate Bearings to 1,000F

Successful operation of metal bearings at temperatures approaching 1,000F without the aid of conventional lubrication is reported by Shell Development Co. research scientists. Operation of guided missiles and hypersonic aircraft in temperatures now considered extremely difficult or impossible is promised by the new lubricating method, called "protective atmosphere" lubrication. Oils and greases now in use limit bearing operating temperatures to about 500F.

The project was described in a paper entitled "Protective Atmosphere for High-Temperature Bearing Operation" by C. H. Bailey, Stanley S. Sorem and A. G. Cattaneo which was read by Dr. Cattaneo before an annual meeting of the Society of Automotive Engineers at Detroit. Work was done under Air Force contract at the Shell Development Co.'s laboratories at Emeryville, Calif.

Investigation was based on the theory that there is no metallurgical reason why roller bearings made of tool steel cannot operate satisfactorily at temperatures up to at least 1,000F. Dr. Cattaneo explained that there are many examples in industry of steel rolling successfully on steel without oil—notably a railroad wheel rolling on its rail.

Tests carried out on the cantilever end of a 10,000 rpm. spindle with an electrically-heated bearing housing proved that mechanical details, including bearing fit, alignment and cage balance, were extremely important. Consistent test results also demanded a "break-in" of bearings by operation with oil lubrication before test runs.

Bearing breakdowns, it was learned, were caused by iron oxide which formed during the dry operation and acted as an abrasive. This problem was solved by the addition of a small amount of hydrocarbon vapor to the air, attracting the oxygen before it could attack the bearing surfaces. This permitted test runs of several hours before bearing failures occurred.

When failure did occur, it was the result of scuffing, or metal pickup, on the rubbing surfaces of the cage. In conventional lubrication, scuffing is prevented by use of "extreme pressure" additives which alloy with metal to provide a lubricating surface. It was found that if such additives were used during the "break-in" period and were then added in vapor form with the hydro-carbon vapor, a lubricating film developed on the rubbing surfaces of the cage and rolling elements. This method has been used to operate bearings for 100 hr. at temperatures approaching 1,000F without any evidence of bearing failure.

In regard to aircraft use, Dr. Cattaneo mentioned that it was "particularly fortunate" that JP4, a widely used jet fuel, had been found especially useful in providing the protective atmosphere used in the test. The fuel was found to contain certain resins which combine with "extreme pressure" additives to form improved lubrication films on the bearing surfaces.

Shell is continuing the research on "protective atmosphere" lubrication at Emeryville with emphasis on defining optimum combinations of materials and mechanical configurations for use with the new method.

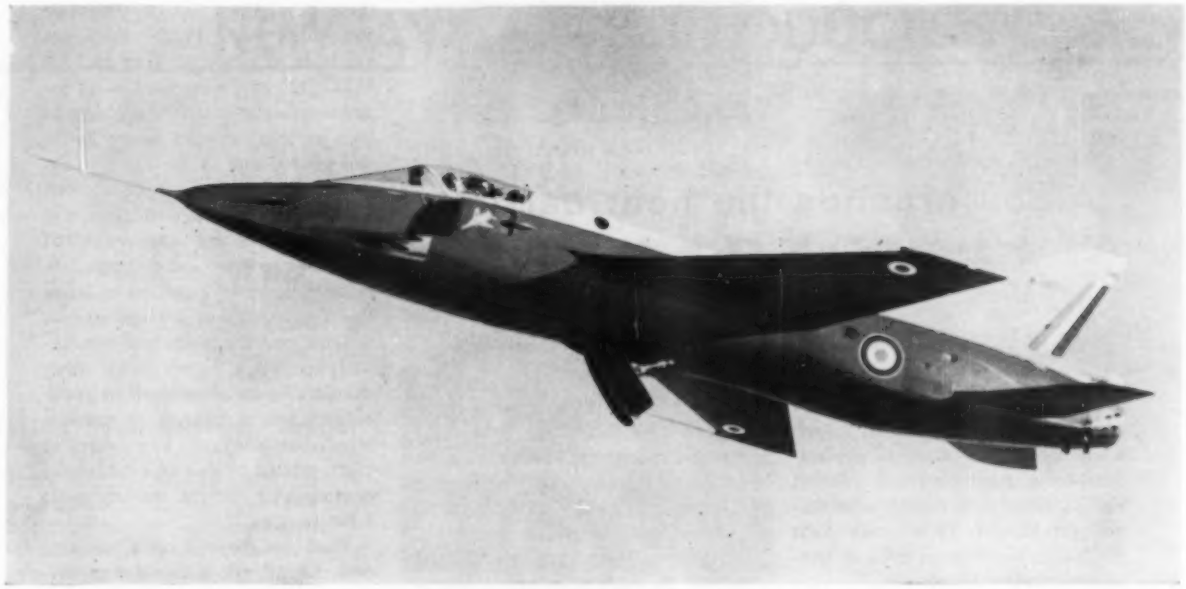
Technique Controls Titanium's Oxygen

Direct control of oxygen content in the manufacture of titanium alloys is now possible on a production basis with vacuum fusion method oxygen analytical techniques.

Control of oxygen content in titanium alloys, up to now achieved by indirect means such as hardness tests and tensile ductility determinations, is of critical importance if satisfactory and reproducible mechanical properties and fabrication characteristics are to be obtained.

Research workers at the Titanium Metals Corp. of America developed a technique utilizing the platinum bath vacuum fusion method of oxygen determination for application in the production of titanium alloys.

Test apparatus consists essentially of three parts: Furnace section, evacuation system and analytical system. The furnace is a Pyrex envelope which can be induction-heated to 2,400C. It is evacuated by two mercury diffusion pumps



Breguet Modifies Taon

Breguet's first Taon lightweight fighter displays modifications based on results of flight testing. Intake doors, partly open just behind insignia, facilitate engine operation at low speeds. Air brakes, extended on belly, were moved forward. Vortex generators dot the tailpipe aft of the horizontal stabilizer. Second prototype, the Taon 1002, has flown, and third prototype, the 1003 that will be powered by the Bristol Orpheus 12 instead of the Orpheus 3 of the earlier versions, is under construction.

which create vacuum and draw off gases to be analyzed. The analytical system is an absorption type, consisting of a collection volume, an absorption flask and a pressure gage.

Analytical procedure involves placing a prepared sample of titanium alloy (cut from the parent metal) into the platinum bath at 1,900C. The gases are then exhausted and pumped into the analytical system. Here the gases are analyzed by first measuring the pressure and then opening the absorption bulb.

Reagents present in the absorption flask oxidize carbon monoxide and absorb resultant carbon dioxide, after which gas pressure is again measured. The oxygen content of the alloy is a function of the resulting pressure differential.

Research workers conducted experiments with various titanium alloys and in every case the recovery was found to be within limits of analytical precision and showed no erratic results.

WHAT'S NEW

Publications Received:

Space Flight and Satellite Vehicles—by R. B. Beard & A. C. Rotherham—Pub. Pitman Publishing Corp., 2 West 45th Street, New York 36, N. Y. $3.95; 150 pp.

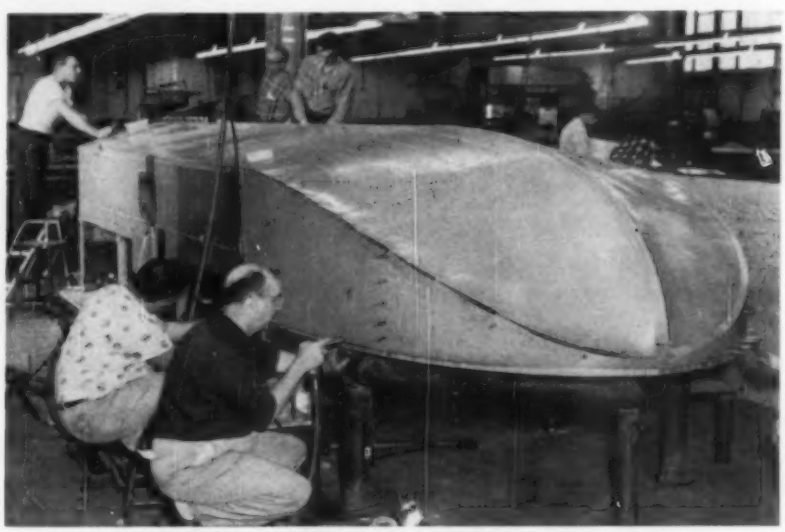
A survey of developments and an assessment of imminent developments in interplanetary flight.

Reports Available:

The following reports were sponsored by the Office of Technical Services, United States Department of Commerce, Washington 25, D. C.

Stainless Steel and Titanium Sandwich Structures—by W. J. Lewis, G. E. Faulkner and P. J. Rieppel, Titanium Metallurgical Laboratory, Battelle Memorial Institute for Office of Assistant Secretary of Defense for Research and Development. August, 1957. $1.00; 39 pp. (PB 121633).

The Physical Properties of Titanium and Titanium Alloys—by W. J. Lepkowski and J. W. Holladay, Titanium Metallurgical Laboratory, Battelle Memorial Institute for Office of Assistant Secretary of Defense for Research and Development. July, 1957. $2.25; 87 pp. (PB 121629)



S-62's Hull Nears Completion

Flying boat hull of the Sikorsky S-62 amphibious turbine-powered helicopter is shown in final stages of construction, just prior to being inverted so that work can begin on the remainder of the fuselage. First flight of the S-62 (AW Dec. 30, p. 25) is slated for May.

Alcoa crashes the heat barrier

Alcoa Aluminum Powder Metallurgy Products withstand temperatures up to 900°F; open up NEW weight and cost savings

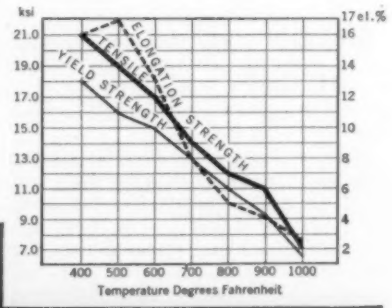
The new Alcoa® Aluminum Powder Metallurgy Products (APMP) open a whole new area of special applications for aluminum parts in aviation design. Already in regular commercial production, they retain their mechanical properties even at temperatures 400° F above the thermal breaking point of conventional aluminum alloys. This means that lightweight, low-cost aluminum can now be used in hundreds of applications where extremely high temperature conditions, under moderate loading, are encountered. They are ideal for shielding applications, for example.

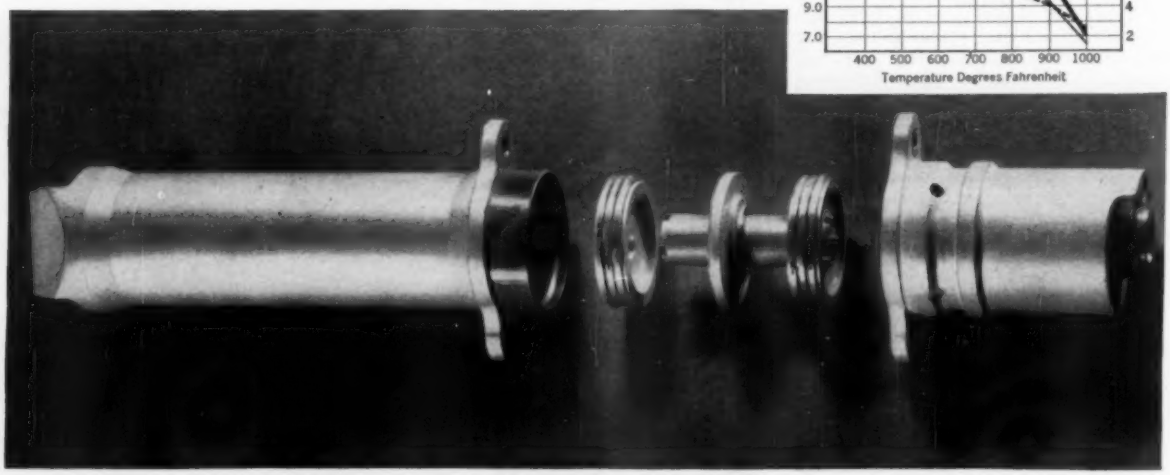
Years of investigation and testing by Alcoa Research Laboratories led to the development of these fine unalloyed aluminum powders, coated in processing with aluminum oxide to give them their remarkable heat resistance. Strength and stability are added by forming the powder into "compacts" through subjecting it to extreme heat and pressure.

Alcoa APMP alloys have already proved themselves in actual operation. They are being used for standard production parts fabricated by Ex-Cello Corporation for Pratt & Whitney Aircraft's new jet engine, the J75. Optimistic reports are pouring in from test applications of the new alloys as extrusions for hot air valve housings, metal and foil sheet for honeycomb sandwich structures, tube for airborne heat exchangers and all types of fasteners.

You can design the benefits of these new Alcoa alloys into your equipment *now*. Three alloys are available in quantity. They include M257, already being used in jet engine applications at temperatures as high as 900° F, and alloys M430 and M470. You can get them in extruded shapes, rod, forgings, sheet, foil, drawn and extruded tube, impact extrusions and fasteners. All of them cost less and are easier to fabricate than either titanium or stainless steel. Also they are lighter, save weight, and their thermal conductivity is much higher than either titanium or stainless steel. In applications where friction is encountered, these alloys can be anodized or electroplated to give an even harder coating and prevent moving parts from sticking.

Find out how Alcoa's amazing new APMP alloys can design savings and lighter weight into your products. Call your local Alcoa sales engineer. Aluminum Company of America, 1800-B Alcoa Building, Pittsburgh 19, Pa.





Already in use, Alcoa's new APMP alloy M257 is giving dependable service in Pratt & Whitney Aircraft's J75 jet engine. The parts shown in this exploded view were made of Alcoa's APMP alloy M257 and were fabricated by Ex-Cello Corporation for use in the after-burner activating cylinder assembly, at temperatures ranging from 600 to 900°F. Insert: Chart showing tensile and yield strength and elongation of Alcoa APMP alloy M257 at various temperatures.

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

"ALCOA THEATRE" Exciting Adventure, Alternate Monday Evenings

NEW AVIATION PRODUCTS

Cooling Effect Detection, Control

Cooling effect detection and control system cools aircraft and missile equipment by means of ram and refrigerated air. Advantages claimed by the manufacturer are: reduces engine power needed for refrigerating turbine, sensitive to both air temperature and airflow, and maintains constant cooling effect. System consists of a cooling effect detector, a magnetic amplifier control assembly, and a warning system or actuator-valve assembly. System holds cooling effect below critical maximum temperatures with a variance of plus or minus 5F, the maker states.

Barber Colman Co., Rockford, Ill.

Missile Synchros

Size 11 synchros are designed specifically to withstand the severe environment associated with missile applications. Synchros are claimed to perform under four major environmental conditions: corrosive, high temperature, vibration and shock. Housing shafts and

bearings are stainless steel. Synchros are accurate to within 10 deg. of electrical zero over temp. range of −54C to + 200C. They are said to operate within specifications after shocks of 50Gs and withstand 20Gs over a vibration spectrum of 20 to 2,000 cps.

Kearfott Co., Inc., Little Falls, N. J.

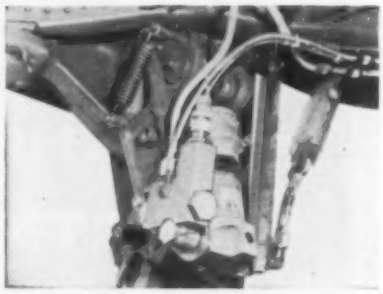
Dry Chemical Extinguisher

Portable firefighting unit utilizing dry chemicals is claimed by the maker to be the first successful application of dry chemical for the control of major fires. Originally designed for major oilfield fires, the unit is said to be valuable in combating aviation and industrial fires.

Tank capacity is 1,500 lb. of dry chemicals. Tank outlets are at the top when the equipment is idle, preventing the dry chemicals from clogging the outlets. In use, the sphere is automatically inverted to working position. Propellant for chemicals is compressed nitrogen. Dry chemicals are assisted by

any combination of eight wetting agents. Water is contained in second spherical tank. Side tanks have capacity of 30 gal. 3% foam, 30 gal. of wet water and 880 cu. ft. of nitrogen. Unit can be operated by one man, but from two to four operators are recommended.

Fire Boss, Inc., 411 West Second, Odessa, Texas.



Landing Gear Actuator

Landing gear uplock actuator for emergency use in the event of failure of the hydraulic or pneumatic system utilizes a propellant cartridge to release uplocks. Model 143 is designed for both military and commercial use. Characteristics are: weight 0.27 lb., envelope dimensions 2.5 in. x 3 in. x 1 in., firing voltage 12 to 30 v., firing current 10 amp., time to 1,000 psi. eight milliseconds, gas pressure and volume output to specifications. Unit may be initiated electrically or mechanically.

Propellex Chemical Corp., P. O. Box 187, Edwardsville, Ill.

DESIGN ENGINEERS

For mechanical, structural, or electrical design on airplanes or missiles.

ALSO NEEDED ARE:

Systems Engineers	Strength Engineers
Sr. Aerodynamics	Dynamicists
Sr. Flight Test Engineers	Sr. Test Engineers

Engineers experienced in one or more of the above fields are invited to write to:

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Aircraft Corporation
ST. LOUIS 3, MO

LOCKHEED ELECTRA...

the only practical, economically sound air transportation machine for "short-to-medium haul" airline routes!

"SHORT-TO-MEDIUM HAUL"—WHAT IS IT?

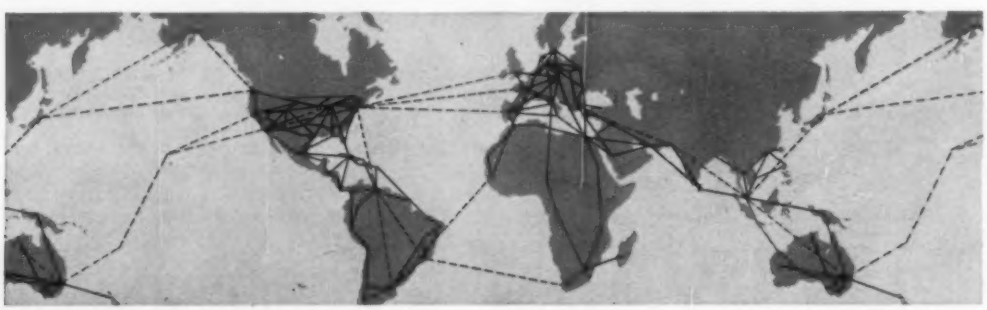
Route patterns divide into "long-haul," "medium-haul," and "short-haul"... each with different characteristics... each requiring a specialized air transport to fit its needs. Short and long-haul characteristics and the kind of machine needed are most clearly defined. Medium-haul is between the two, and is less clearly definable.

ROUTE DEFINITION

(1) LONG-HAUL... a pattern of long, non-stop flights between big cities with big airports—generating heavy traffic.

TRANSPORT REQUIREMENT

(1) Requires the large turbo-jet powered airplane, flying at high cruise speeds and high altitudes for long periods.



(2) SHORT-TO-MEDIUM HAUL... involves a varied pattern with many intermediate stops—with lower flying altitude for shorter periods—and between large, medium and small cities... some with small airports and with traffic varying from very heavy to very thin.

(2) Requires a highly specialized, flexible machine of just the right size and carefully tailored to fit "short-to-medium" haul needs. Emphasis must be on economics since airline unit operating costs are inherently higher in this area.

Since 35% to 65% of air traffic travels on "short-to-medium" haul routes, profit or loss on this portion of the system determines airline financial success.

LOCKHEED ELECTRA...

The Electra is the *only practical* air transport in the market or under development, *explicitly* designed *from the very start to* fit the particular functional needs of "short-to-medium haul." It was designed and produced by the greatest team in aviation history:

Aircraft... by Lockheed (California Div.)
Power... by General Motors (Allison Div.)
Airline functional counsel by:
American Airlines
Eastern Airlines
(among the largest, most profitable airlines in the world in "short-to-medium haul" field.)

Sponsorship by:
Aeronaves de Mexico
American Airlines
Ansett/ANA of Australia
Braniff Airways
Cathay-Pacific Airways
Eastern Air Lines
Garuda Indonesian Airways
KLM Royal Dutch Airlines
National Airlines
PSA—Pacific Southwest Airlines
Western Air Lines

(Total of 144 Electras on order—for over $300,000,000)

THIS OUTSTANDING TEAM, by employing the most advanced aircraft and turbine power technology in the *proper combination for the required job in the turbine age,* developed and produced the Electra.

RESULTS THAT SOLVE THE SHORT-TO-MEDIUM HAUL PROBLEM FOR *TODAY AND TOMORROW*

Realistic economics:
Profitability under today's *and tomorrow's* operating conditions.
NO UNKNOWNS!

Dependable Passenger Appeal:
Quiet, vibration free. Shortest elapsed trip time and most frequent schedules with all weather dependability.
NOT JUST NOVELTY APPEAL!

Practical Operational Performance:
For "many-stop" schedules under *today's* air traffic control conditions.
NO UNPLEASANT SURPRISES!

Realistically Achievable:
Highest utilization, shortest ground time with practical load factors on "many-stop" schedules.
THE TOOL FITTED TO THE JOB!

LOCKHEED AIRCRAFT CORPORATION
Burbank, California

HELICOPTER lowers heavy heating unit case to roof of new Atlas missile plant building now under construction at San Diego, Calif.

S-58 Transfers 103 Tons in Six Hours

San Diego—A single Sikorsky S-58 helicopter recently spotted more than 100 tons of heating and ventilating equipment on the 13-acre roof of a missile plant being built here for Convair Astronautics Divisions of General Dynamics Corp.

Lifting job, which required about 70 quarter-mile flights, was accomplished in six flying hours. A representative of Sikorsky Aircraft Division of United Aircraft Corp. described the task as the largest ever performed on a plant construction project.

Airlift was conducted by Rotor-Aids, Inc., of Ventura, Calif., operator of a fleet of 30 helicopters in California, Alaska and the Gulf of Mexico. Operators guaranteed to position the units to a tolerance of less than one inch.

Equipment was lifted to the roof of Convair's new Atlas missile factory building, one of six major buildings near Montgomery Airfield which, along with eight smaller ones, will cost $40,000,000. Work was done for Bovee & Crail Construction Co., Paramount, Calif., the heating and plumbing subcontractor under McNeil Construction Co., Los Angeles.

Joe C. Russell, Bovee & Crail San Diego manager, said use of cranes to hoist the 38 heating and 56 ventilating units would have necessitated roof reinforcement with heavy planking, at higher costs in time and money. Cargo gross weight, which included 22 tons of pipe, was 206,800 lb.

Airlift, much of it conducted in light rainfall, consisted of picking up cargo stockpiled on a parking lot, carrying it to the factory and lowering it while a crew of riggers hand-jockeyed the units into precise position.

Heating units weighed 3,400 lb. each and consisted of heavy-duty hot water heater (375,000 Btu./hr.) and electric motor and fan, all mounted on sub-base. Units were packed in a sheet metal housing.

Russell said use of the helicopter "saved thousands of dollars and about four weeks' time." Lifting job, according to R. H. Kwiatowski, Sikorsky sales representative, was first airlift of this magnitude in connection with building construction. He termed job "relatively easy," in comparison with helicopter airlifts performed for petroleum companies in the Gulf.

SPOTTER in doorway directs helicopter pilot in disengaging maneuver.

BUSINESS FLYING

FIRST crate arrives on rooftop in light rainfall. Unit weighs 3,400 lb.

S-58 on one of its 70 quarter-mile flights.

AIRLIFT for Convair Astronautics Division plant was described as largest done yet on a construction job. Gross weight was 206,800 lb.

Barden Precision SFRI-5 miniature bearings as used in a computer gear train.

Specify **BARDEN** *Precision miniature ball bearings*

Precision-built computer gear trains must have uniformly low torque and minimum backlash; mounting surfaces for the bearings should be simple to manufacture.

Barden Precision miniature-size bearings have the required low torque. Their low eccentricity and closely controlled radial play assure minimum backlash. Precision flanges provide accurate positioning surfaces and permit through-boring, eliminating the need for housing shoulders.

Barden Precision miniature bearings are built to the same high standards of consistent quality as Barden's larger instrument sizes.

Barden Precision means not only dimensional accuracy but performance to match the demands of the application.

Your product needs *Barden Precision* if it has critical requirements for accuracy, torque, vibration, temperature, or high speed. For less difficult applications, the *predictable* performance of *Barden Precision* bearings can cut your rejection rates and teardown costs.

Write today for your copy of Catalog Supplement M1 which gives dimensions, performance and engineering data on *Barden Precision* ball bearings 5/8" O.D. and smaller.

THE **BARDEN** CORPORATION

41 E. Franklin St., Danbury, Connecticut • Western office: 3850 Wilshire Blvd., Los Angeles 5, California

SPECIFY BARDEN PRECISION BALL BEARINGS FOR: INSTRUMENTS • AIRCRAFT ACCESSORIES • COMPUTERS AND RECORDERS • MACHINE TOOL AND TEXTILE SPINDLES • OTHER PRECISION APPLICATIONS

Czechs Manufacture 3-Seat Utility Plane

Czechoslovakia's Avia factory has put its recently-developed three-place utility aircraft into quantity production.

All-metal high-wing monoplane, equipped with a 200-hp. air-cooled "Prague-Doris B" engine, is intended for agricultural, photographic, ambulance and glider-towing work. Rear section of the cockpit canopy opens upward to permit loading large-sized pieces of cargo.

Fuselage is of semi-monocoque construction. Wing is braced to the fuselage on V-shaped struts. Trailing edge, flaps and leading-edge slots are electrically operated. Ailerons are slotted. Rudder and elevators are fabric covered.

Specifications are: length 28 ft., height 9 ft., wing span 44.6 ft., wing area 261 sq. ft., landing gear track 9.84 ft., wing loading 11.52 lb. per sq. ft.

Empty weight is 1,837 lb., gross weight 3,014 lb., maximum speed 118 mph., minimum speed 32.3 mph., climb 8.86 ft. per sec., takeoff distance over 50-ft. obstacle is 535 ft., landing distance over 50-ft. obstacle is 453 ft., range is 447 mi.

Civil Plane Exports Climb 17% in 1957

Exports of U.S.-built business and utility aircraft weighing 6,000 lb. or less in 1957 totaled 1,131 units valued at $17,372,539, an increase of 17% in units and 40% in dollar volume over 1956. Five firms: Aero Design & Engineering, Beech, Cessna, Piper and Taylorcraft reported these totals.

Detailed breakdown of 1957 shipments abroad (units in parentheses): Afghanistan (1), Algeria (6), Argentina (198), Australia (46), Austria (15), Belgian Congo (1), Belgium (8), Bolivia (4), Brazil (63), British East Africa (6), British Guiana (1), British West Africa (1), Burma (6), Canada (156), Colombia (10), Costa Rica (8), Cuba (8), Ecuador (2), El Salvador (4), England (1), France (9), French Equatorial Africa (7), French West Africa (9), Germany (19), Guatemala (7), Honduras (9), India (1), Indonesia (2), Iran (7), Iraq (5), Ireland (3), Israel (5), Jamaica (1), Japan (7), Laos (2), Liberia (2), Libya (1), Madagascar (2), Mexico (61), Morocco (5), Netherlands (3), New Caledonia (1), New Zealand (78), Nicaragua (17), Norway (5), Pakistan (1), Panama (2), Paraguay (6), Peru (6), Philippines (2), Portugal (2), Portugese East Africa (1), Sweden (7), Switzerland (25), Trinidad (1), Union of South Africa (58), Uruguay (94), Venezuela (15). Also, Alaska accounted for 75 units and Puerto Rico for nine.

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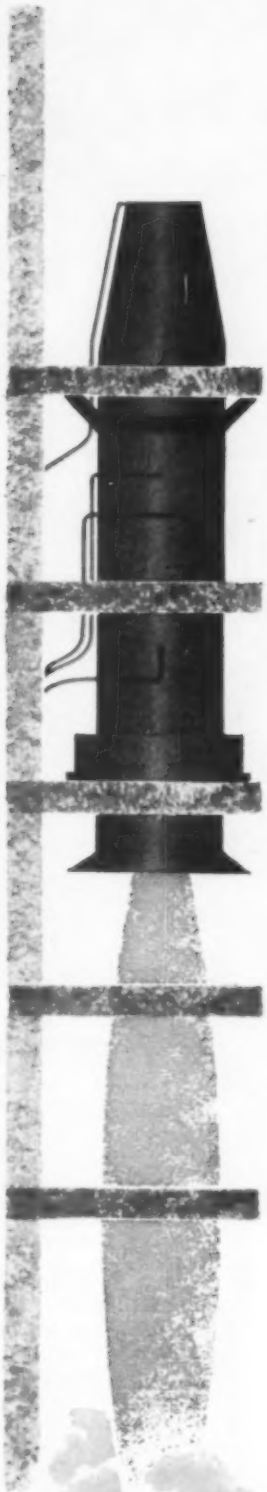

The revolutionary Type 40-101 PLEXICODER commutates signals from up to 90 transducers at 112.5 samples per second and converts them into duration-modulated pulses suitable for telemetering or magnetic-tape recording. The PLEXICODER accepts single or double-ended, positive or negative, low-level inputs from strain gages and thermocouples. Galvanometers (with inherent filtering characteristics) and an optical system replace rotating wiper-arm assemblies and complex electronic circuitry. Operating modes can be changed easily with adapter plugs. Over-all system accuracy is 1%. Maintenance in the field is accomplished without return to the factory... service-free life is a nominal 1000 hours. The PLEXICODER weighs 45 lbs., measures 25" high by 8¼" in diameter. Designed for flight-test instrumentation for missiles, rockets, or manned aircraft... ideal for engine test stands, telemetering systems, and ground-based data-handling systems. Call your nearest CEC sales and service office, or write for Bulletin 1599-X1.

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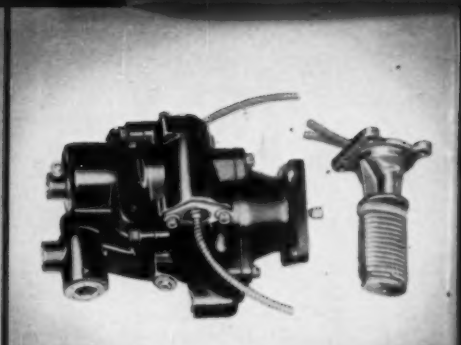
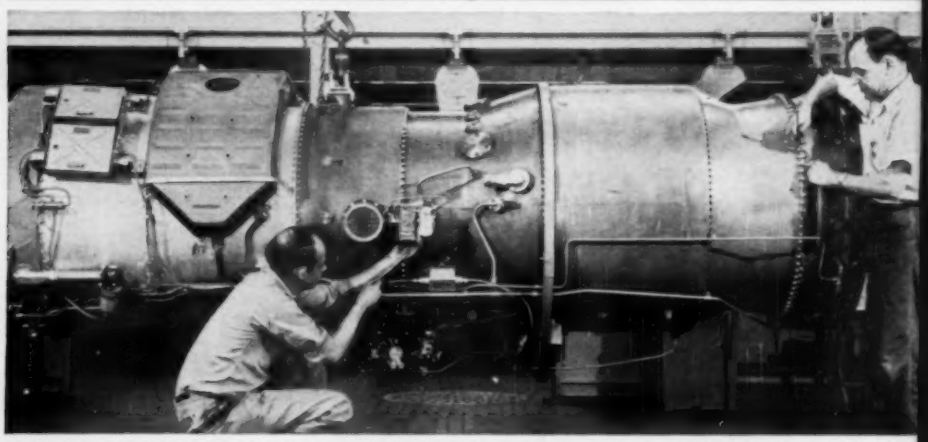
Holley engine controls selected for JT4 engines on America's first jet airliner

BLEED PISTON ACTUATOR

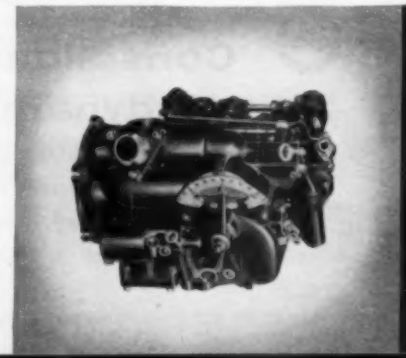


COMPRESSOR BLEED GOVERNOR



Powered by four JT4 Pratt & Whitney Aircraft engines, the Boeing 707-320 will carry 131 first class passengers from New York non-stop to the Continent in just over six hours! Each of these new engines, commercial counterparts to the J-75 which drives many of America's latest jet fighters, delivers up to 15,000 pounds of thrust. Ability to pack so much added power into a relatively small space is the result of designing engine components which will operate at higher efficiency, require less area and reduce over-all weight.

Holley Carburetor Company, working closely with Pratt & Whitney Aircraft engineers, carried out this exacting assignment on such vital engine components as: the compressor bleed governor, and the bleed governor actuator. For single and multi-engine military aircraft, the Holley main fuel control is a companion unit to the Holley governor and actuator.



For military applications, the Holley main fuel control (right) is a companion unit to the governor and actuator.

HOLLEY Carburetor Co.

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PRIVATE LINES

Production of new Piper Comanche all-metal business plane (AW Nov. 11, p. 100) is building up; company delivered 26 Comanches in January, is scheduling 35 for next month.

Cessna has been awarded an additional contract for its L-27A light twin (Model 310) by the Air Force totaling more than $4.5 million. Deliveries under this contract begin in May. Award follows receipt of an additional contract for further T-37A twin-jet trainers totaling more than $10 million, extending production on this airplane well into 1959.

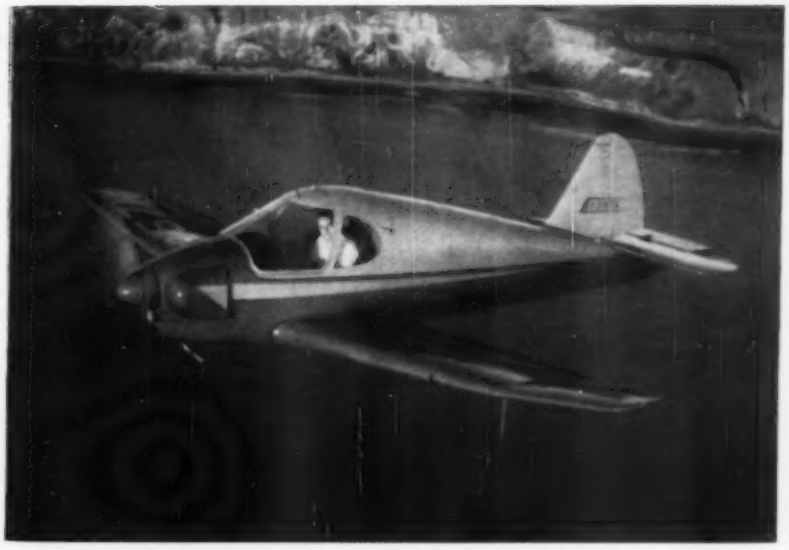
Management, sales, advertising, publicity and promotion techniques especially designed to increase flight school operator's business is being offered by National Assn. of Flight Schools, Minneapolis, Minn. Organization plans to develop an annual convention featuring panel discussions of interest to school operators.

Approximately $3.5 million worth of spares for T-34B Mentor trainer have been ordered from Beech by the Navy. Beech estimates that sales of spares and other support items for its military and civil aircraft will exceed $16 million during Fiscal 1958.

"Admission of Aircraft to Canada" is pocketsize 19 pp. booklet providing important information for private and business pilots planning to cross the border. Provided are flight plane requirements, landing and departure formalities, air navigation aids listing, and list of all airports and customs offices. A reference map shows areas for which air navigation charts are available. Write: Canadian Government Travel Bureau, Ottawa, Canada. Booklet is gratis.

Lycoming and German Bayrische Motorenwerke (BMW) Triebwerkau GmbH., Munich-Allach, has signed agreement under which BMW will produce Lycoming GO480 piston engine and handle sales and service of the U.S. powerplants used in Germany.

Letter contract covering $600,000 in military aircraft maintenance has been received by Aircraft Engineering & Maintenance Co., Oakland, Calif., from USAF. Contract covers modification of a fleet of MATS-operated Douglas C-124 Globemasters, will require hiring of 200 additional employes during the next six months. Aemco will handle project in a new hangar under lease. Firm recently completed processing of 3,036 USAF T-33A jet trainers.



Comeback for Culver Lightplane

Modernized version of two-place Culver lightplane, in production by Superior Aircraft Co., Culver City, Calif., is shown undergoing flight tests on West Coast. Powered by 95-hp. Continental, the new Satellite, as it has been renamed by Superior, shows a 130-mph. cruise speed and range of 750 mi. Useful load is stated to be 572 lb. Construction is wood, with reinforced plastic outer skin. Superior reports it has the first 45 Satellites on the production line, with 15 nearly completed. Basic price is $6,720. Powered landing gear retraction system is $166 extra. Among features of Culver lightplane are interconnected flap and stabilizer providing for trim adjustment when flaps are lowered.

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Here Maurice Tucker, Manager Aero & Thermodynamics Department, second from left, discusses heating of jet control surfaces with (left to right) W. E. Brandt, R. L. Nelson, B. W. Marsh, J. I. Osborne (back to camera).

Lockheed MISSILE SYSTEMS

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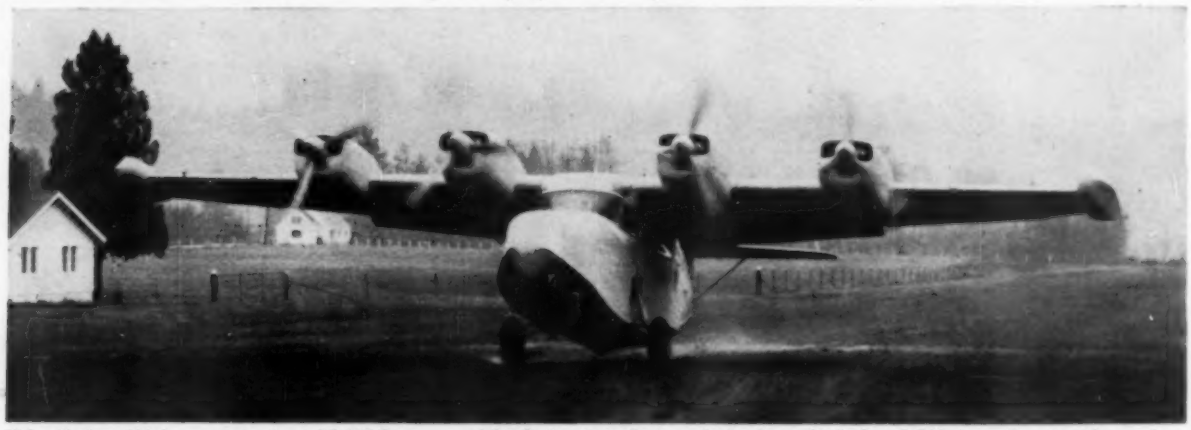
CALIFORNIA

Nose extension, providing room for radar, retractable wingtip floats, large picture windows and enlarged dorsal fin are earmarks of new McKinnon Goose business amphibian.

Four-Engine Goose Starts Tests

Rough-field landing, with wheels splashing into water, is made by four-engine Goose during its test program into strip measuring 2,500 ft. long and 100 ft. wide.



Takeoff after 600-ft. run is made at 11,000-lb. gross weight during test, during which plane climbed at 2,500 fpm. It gets airborne from water at this weight in 10-12 sec. Initial test data shows that at 10,000 ft., McKinnon Goose does 225 mph. at 65% power of its Lycoming supercharged engines; lowering wingtip floats costs 15 mph. Six-eight passenger Goose can be converted using McKinnon-developed kit costing $125,000-$130,000. Empty weight is 8,500 lb., gross is 12,000 lb.

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New Viscount Version Cuts Refueling Time

London—New version of the Viscount airliner, specially developed for local service operation, will be capable of a series of up to five short intercity stages of less than 100 mi. without refueling or servicing at transit stops, according to Vickers-Armstrongs Inc.

The manufacturer recently released details of the new plane, described by AVIATION WEEK Oct. 14, p. 45.

Structural changes include a redesigned interior layout and a reinforced wing to meet unusually low altitude cruising conditions of 300 mph. at 10,000 ft. Engines are to be Rolls-Royce Dart 506, chosen in preference to later and more powerful versions.

Deliveries of the local service Viscount are slated for mid-1959 and the company reports that the specification is already "being closely studied" in the U.S.

The new cabin layout provides for 65 passengers in a high density arrangement with five abreast seating, and will incorporate the revised cabin trim line developed for the 800 and 810 series Viscounts. Aisle width is 16 in. Accommodation for 54 passengers is provided in a "standard" version which seats four abreast.

A two-crew layout is featured in the flight deck with a supernumerary seat, and a forward vestibule houses the hydraulically operated folding stair steps, toilet and galley equipment.

Because of the lower cruising altitude the cabin pressure differential drops from 6.5 psi. to 4.5 psi. giving sea level conditions at 10,000 ft., and 7,000 ft. conditions at 20,000 ft.

Reduced pressurization loads on the fuselage more than compensate, the company claims, for the increased number of pressurization cycles incurred above aircraft's original design life.

At transit stops, No. 4 engine will be kept running to provide power for engine restarts. But increased internal battery capacity is provided should there be a requirement to restart all engines. Windmilling of propellers on Nos. 1, 2 and 3 engines is prevented by braking. Maximum takeoff weight is 61,500 lb., maximum payload 11,620 lb.

In offering a "proved airframe, engine/systems combination," operational background is now a million hours. The company also points to a world-wide aftersales service, including over-the-counter spares stock and technical advice at Washington which should enable the aircraft to go straight into airline service. "Economics of local service operation," the company suggests, "will not permit an extensive debugging period when a new aircraft enters service."

LOWER cost and weight and a background of local service type experience were points in favor of installing early version of the Rolls-Royce Dart series engine in new local service version of the Vickers Viscount airliner, pictured above. Engine rating is 1,540 eshp. Length of aircraft is 81 ft. 10 in.; span is 93 ft. 11 in. Fully factored range is 800 mi.

This Airwork Extra Keeps The Belly Clean!

Dirty smears on the wing . . . oil drips on the hangar floor. Looks bad! Most of it *could* have been prevented at overhaul.

The overhaul manual allows a 0.006" taper in the valve stem, and a minimum clearance of 0.0045" between stem and guide. Maximum acceptable clearance is 0.0105". But—if you get it—you'll also get oil leaks.

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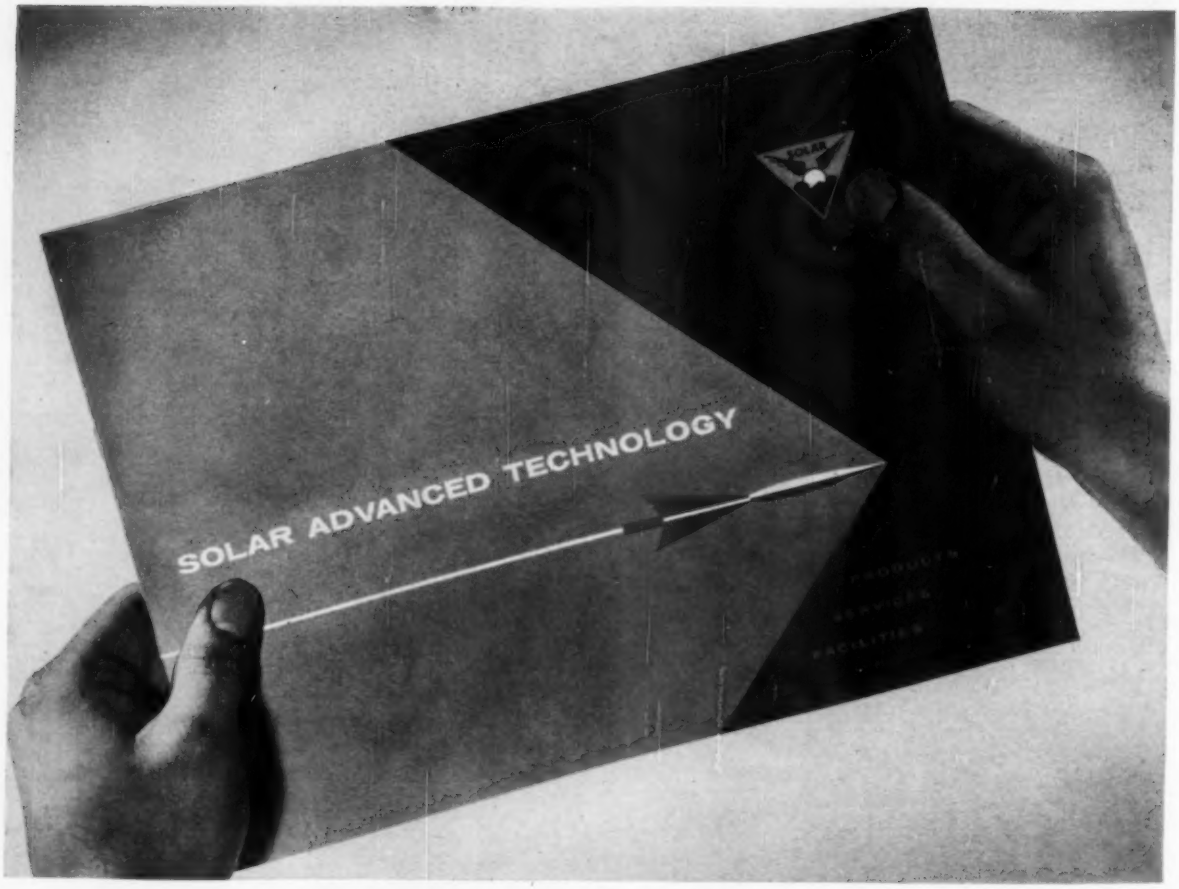

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CAB Accident Investigation Report:

Passenger Blamed for In-Flight Explosion

About 0337,[1] July 25, 1957, an explosion occurred in the lavatory of Western Air Lines Flight 39 during flight near Daggett, Calif. The blast ruptured the fuselage shell and outrushing air from the pressurized cabin enlarged the rupture. A passenger, apparently intent on suicide, was blown out through the opening. The aircraft, a Convair 240-1, N 8406H, was landed without difficulty at George AFB, Victorville, Calif. There were no injuries to other occupants.

Western Air Lines Flight 39, a scheduled Convair passenger flight, originated at Rochester, Minn., for Los Angeles, Calif., with intermediate stops en route including Salt Lake City and Cedar City, Utah, and Las Vegas, Nevada.

HISTORY OF THE FLIGHT

A regular crew change had been made at Salt Lake City with Capt. Milton L. Shirk, First Officer Seth M. Oberg and Stewardess Joan M. Hollinger taking the flight to Los Angeles. The flight departed Salt Lake City on schedule, landed at Cedar City and arrived at Las Vegas at 0221, 12 min. ahead of schedule. Total gross weight at takeoff from Las Vegas, including fuel, passengers and baggage, was 35,300 lb., well under the allowable weight of 40,909 lb.; the load was properly distributed.

On board were 12 adult passengers and one infant.

While the flight was being prepared for departure from Las Vegas, the crew obtained an air traffic control clearance from Air Route Traffic Control. Flight 39 was cleared, as requested, to Los Angeles via Victor Airway 21 to Fontana, Calif., and thence direct to Los Angeles, to maintain 12,000 ft. Visual flight rules conditions existed at Las Vegas at 0255, the time of departure.

Descends to 10,000 Ft.

About 0322, subsequent clearance was transmitted, via the company radio at Los Angeles, for the flight to descend to and maintain 10,000 ft., and to contact Los Angeles Air Route Traffic Control on 120.3 mc. over the Arrowhead intersection. At 0324 the flight reported, to company radio, leaving 12,000 ft., and descended to 10,000 ft., on course, at 500 fpm. At 0331, Flight 39 reported over Daggett at 10,000 ft., in the clear, estimating Fontana at 0347 and Los Angeles at 0405.

Soon after this transmission was completed there was a loud noise from the rear of the aircraft. Hurried inspection by the crew members revealed extensive damage in the vicinity of the lavatory and a large opening in the fuselage shell in that area. A check showed one passenger missing.

Radio contact was established at once with George AFB, about 37 mi. away, an emergency was declared and a clearance was received for a landing there.

This landing was effected without difficulty at 0348.

A check immediately after the landing revealed that Passenger Saul F. Binstock, who had boarded the aircraft at Las Vegas, was unaccounted for.

INVESTIGATION

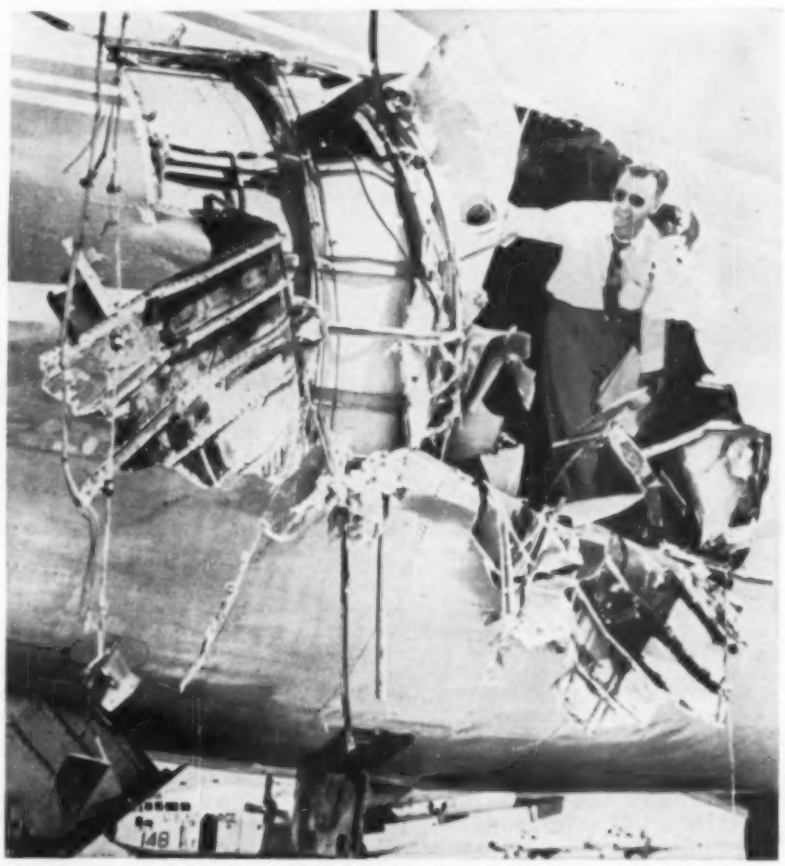
Investigation disclosed that Mr. Binstock had taken seat 9-A, which was second from the rear of the cabin on the left. He sat alone, next to the window.

Behind him another male adult passenger sat, also alone.

The latter tesified that about 15 min. after takeoff, Mr. Binstock rose and went into the lavatory, only a few steps away, to the rear and on the opposite (right) side of the cabin. He remained there so long that the passenger was on the point of informing the stewardess, being prompted by the man's elderly appearance and the fact that the air was slightly rough. He also thought the passenger might have fainted or had some trouble in the lavatory. However, he did not query the stewardess, and Mr. Binstock remained in the lavatory, and was in there when the explosion occurred, about 20 min. after he left his seat.

Another witness and his wife were sitting just across the aisle from Mr. Binstock. They stated that shortly after takeoff from Las Vegas they observed this passenger sitting across from them and that there did not appear to be anything unusual in his actions except that all of a sudden "he more or less popped up in his seat, stood erect, and walked toward the rear of the airplane." Neither of them actually saw Mr. Binstock enter the lavatory but they stated they were positive he did not return to his seat. Both testified that they were awake throughout the flight.

Miss Hollinger, the stewardess, stated



PASSENGER was missing after in-flight explosion blasted hole in lavatory of this Western Air Lines Convair 240-1. CAB investigators found evidence of dynamite.

[1] All times herein are Pacific daylight based on the 24-hr. clock; altitudes are mean sea level.

Tradewind Hits Rock Breakwater

Crippled by a propeller accident 385 mi. off California coast, this Navy R3Y Tradewind flying boat landed in a lagoon adjoining Alameda, Calif., Naval Air Station, striking a rock breakwater. Emergency occurred when two contra-rotating propellers on No. 2 engine broke away and tore through fuselage at 21,000 ft. Plane was further damaged when pitch reversal failed on one engine during landing. Despite mishap, plane still set new 5 hr. 54 min. speed record from Hawaii to San Francisco. There were no injuries.

that only a short while before the explosion she had checked passenger seat belts and all were secured. Most of the passengers were dozing or quiet. The stewardess further stated that after accomplishing other routine duties she sat down in seat 10-D, which was located just ahead of the lavatory wall, next to the windows. She also had her seat belt fastened and was there only moments when the explosion occurred.

The stewardess was nearest to the damaged area. She said, "I looked up and just then I heard a horrible blast, a terrific gush of wind and the cabin filled with a thick fog and an eerie light. I put my hand to my head as I sat bolt upright. My hat was gone and my hair was flying in my face. I was stunned, shocked, I thought this was the end for a minute . . . I knew there was a hole behind me, but I was not about to move. The window on my right was shattered."

Shortly thereafter Miss Hollinger and the passengers nearest the rear of the cabin were moved forward

The stewardess further stated that despite the suddenness of the explosion no one panicked. She immediately gave the passengers emergency instructions and again ascertained that all passenger seat belts were fastened.

A quick count of the passengers showed there were 11, plus one infant, aboard; one passenger was missing.

Most, if not all, of the remaining passengers were awakened by the explosion. All were substantially in agreement that there was a "loud noise." One passenger in a rear seat stated that following the noise there was a tremendous rush of air in the cabin, "cyclone-like in volume," and followed by noises like pieces of the plane tearing off.

Capt. Shirk stated that in the 0331 position report over Daggett he informed the company that the aircraft and radio were o. k., except the cooling was not working properly. Pressurization had been used to maximum and airflow was excellent, except

that it was warm. He was then given the Los Angeles weather.

It was immediately thereafter that the loud report from the rear of the airplane occurred. At that moment the first officer was flying the airplane and he stated he had the sensation that the explosion and the explosive decompression sounded like someone had fired both barrels of a double-barreled shotgun behind his head. He said he noticed no fumes at this time and that the airplane flew normally following the blast while he was at the controls.

Captain's Action

The captain said that he quickly scanned the instrument panel and determined that the exact altitude was 10,000 ft. (7,500 ft. above the ground), cabin pressurization set to an altitude of 4,000 ft. (approximately 2.3 lb. psi.). Outside temperature was +10C, and the indicated airspeed was 185 mph. The engines, radios, and all other components of the aircraft continued to operate normally. Capt. Shirk further said that neither he nor the first officer noticed any indication of cabin pressure rise or fall just prior to decompression.

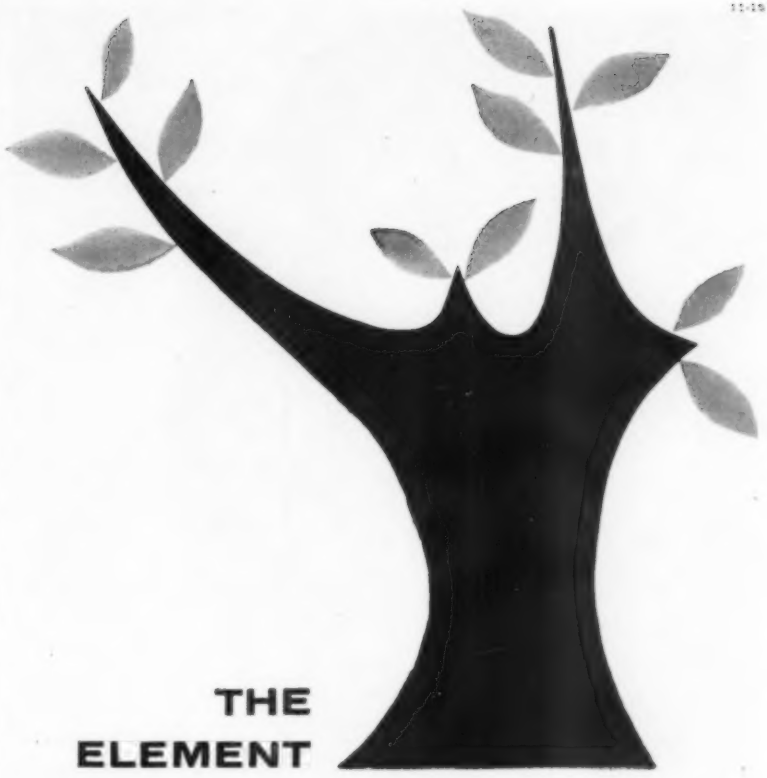
A quick inspection of the cabin by flashlight revealed a hole in the right side of the airplane just forward of the right stabilizer and just aft of rear seat 10-D (where the stewardess was sitting) and generally in the area where the lavatory was located. The hole, visible to him from where he stood in the cabin, looked to be approximately 2 by 5 ft. The captain then ran forward to the cockpit, radioed the company their position, described the damage visible to him, and stated he was making an emergency landing at George AFB where complete emergency facilities were available. The descent, approach, and landing on the air base were accomplished without further incident.

Following the landing the passengers were able to deplane by use of the integral stair-door at the rear of the cabin. An interview of passengers and an inspection of the passenger list at that time revealed that the missing passenger was Mr. Binstock. Further investigation confirmed him to be Mr. Saul F. Binstock, age 62, of North Hollywood, Calif.

Passenger's Body Found

From the outset of the investigation it was evident that the explosion was not due to any mechanical or structural failure of the aircraft or its components, or any action or lack of action by the crew. However, in order to make certain that this definitely was the case, a detailed examination of the damage to the aircraft was made. Simultaneously, a search back along the flight path resulted in the recovery of certain missing parts identified as coming from N 8406H. The body of Mr. Binstock, the missing passenger, was also found. This body showed, in addition to pronounced effects of the fall, a marked mutilation of the left hand, from which finger ends were missing. Mr. Binstock's coat in the area of the left arm and breast was cut and perforated as from the explosion of a blasting cap.

A wreckage distribution chart was prepared during the investigation. It plots the approximate geographical locations of these



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Forward resume to J. L. Hobel, Industrial Relations Manager, Rohr Aircraft Corporation, Chula Vista, California, Dept. 1

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objects having fallen from the aircraft and the location of the body which corresponded to the general flight path of the aircraft following the accident. The distribution of these various items was approximately three miles long in the direction of flight and about one-half mile in width.

The area of the opening in the fuselage shell was about 40 sq. ft., being generally rectangular, and about 7 by 6 ft. It was clearly indicated that there had been an explosion with its forces centered on the washbasin shelf which extends along the outer wall of the lavatory. This conclusion was immediately obvious following a partial reassembly of damaged parts, and in consideration of radiating forces. This partial restoration of parts showed conclusively that the violence of the explosion decreased in all directions from the lavatory shelf. Nowhere was there any evidence of metal fatigue.

Dynamite Explosion

Chemical analyses of smudge found on damaged parts disclosed that the explosive was dynamite, as determined positively by certain ingredients of dynamite which were present in the smudge.

In the cabin lining near the explosion site was found a small fragment of copper. Although it could not be identified as a portion of a blasting cap because of its small size, its chemical composition was consistent with that of the shell of a blasting cap. An unexploded blasting cap was found in the lavatory toilet, together with a number of burned paper matches and pieces of burned paper.

Investigation revealed that Mr. Binstock procured dynamite and blasting caps several weeks before the incident.

Mr. Binstock arrived at Las Vegas at 2015 on the evening of July 24 from Burbank Airport, Burbank, Calif., on Western Air Lines Flight 14. A thorough investigation of his activities while in Las Vegas revealed that they were not abnormal. He had dinner at a hotel and returned to the airport at 0045.

No Reservation

Upon arrival at the airport Mr. Binstock presented his gate pass and ticket to the agent at the Western Air Lines counter. The gate pass indicated Flight 14 out of Burbank on the 24th. The name Binstock was on the ticket plus a first initial the agent could not identify. The agent noted that no reservation card had been made out for Mr. Binstock so he asked him for his first name because the first name is sometimes listed by mistake instead of the last name. To this request Mr. Binstock made a somewhat flippant and vulgar reply. He was then informed that Flight 39 went directly to Los Angeles International Airport and did not stop at Burbank where he had originally started his trip. Mr. Binstock said his car was at the airport in Burbank and further volunteered the information that he had a way to get there. He had no baggage either checked or hand-carried. Following this conversation Mr. Binstock sat directly across from the passenger counter for approximately two hours until the flight's arrival.

The evidence is conclusive that the structural damage which occurred aboard Flight

39 while over the vicinity of Daggett, Calif., was due to a sudden violent explosion in the lavatory. The physical evidence showed that explosive forces emanated from a focal point (i. e., the lavatory washstand shelf) and left a residue that under analysis proved to be unexploded ingredients of dynamite. Further proof existed in the finding of a copper fragment in the cabin insulation similar to the material of an unexploded blasting cap that was also found in the toilet receptacle.

It is clear that Passenger Binstock had previously procured dynamite and that dynamite was in his possession shortly before this accident. It is also clear that the detonation of dynamite aboard the aircraft occurred while Passenger Binstock was in the lavatory and that his left hand was in close proximity to the dynamite at the time of detonation. The fact that burned matches and paper were found in the toilet receptacle makes it evident that there had been previous attempts to detonate the blasting cap before it was successful. Accordingly, the Board concludes that the dynamite was intentionally detonated by Passenger Binstock.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The crew, the aircraft, and the carrier were currently certificated.
2. Passenger Binstock went into the lavatory shortly after takeoff and remained there until the explosion occurred.
3. Heat from burned matches and paper applied to a blasting cap was the method used in exploding the dynamite.
4. Both dynamite and the blasting caps had been procured before the flight by Passenger Binstock.
5. The explosion ruptured the fuselage shell.
6. Outrushing air from the pressurized cabin greatly enlarged the rupture and Passenger Binstock was blown out through the hole.
7. The aircraft remained under control and was landed uneventfully at a nearby Air Force base.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was the act of a passenger in exploding dynamite in flight.

By the Civil Aeronautics Board:

JAMES R. DURFEE
CHAN GURNEY
HARMER D. DENNY
G. JOSEPH MINETTI
LOUIS J. HECTOR

SUPPLEMENTAL DATA

The Civil Aeronautics Board was advised of this accident early on the morning of July 25, 1957.

An investigation was immediately started in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended.

Western Air Lines, Inc., is a Delaware corporation, organized and existing under the laws of the State of Delaware. Its principal offices are located at Los Angeles International Airport, Los Angeles, Calif. It possesses a currently effective certificate of

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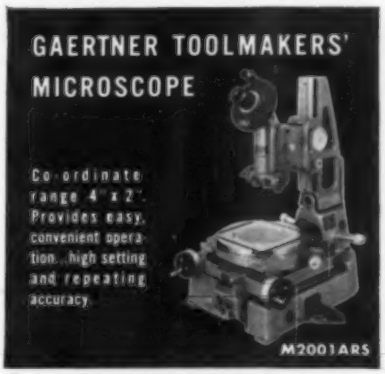
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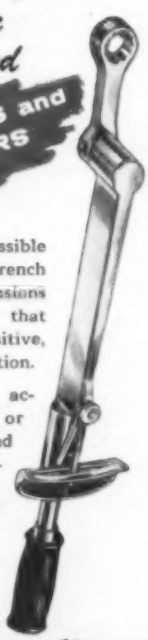

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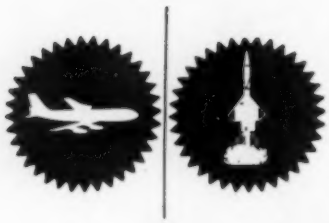

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public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration to transport by air persons, property, and mail over these routes, including that between Salt Lake City, Utah, and Los Angeles, Calif.

Flight Personnel

Capt. Milton L. Shirk, age 37, had been employed by Western Air Lines since March 25, 1946. He held a valid airman certificate with airline transport and multiengine land ratings, and an appropriate rating for the Convair 240-1 aircraft. He had a total of 9,745 flying hr., with 3,092 hr. in the type aircraft involved in this accident.

First Officer Seth M. Oberg, age 25, had been employed by Western Air Lines since September, 1951.

He held a valid airman certificate with commercial rating. He had a total of 1,115 flying hr., with a total of 35 hr. in the Convair 240-1.

Stewardess Joan M. Hollinger, age 25, had been employed by Western Air Lines since June 30, 1954.

She had received the company's standard training and checkout on the aircraft involved.

The Aircraft

N 8406H, a Convair 240-1, had a total time of 21,043 hr., of which 10,093 had been since overhaul. It was currently certificated by the Civil Aeronautics Administration.

The aircraft was equipped with two Pratt and Whitney R2800 engines and two Hamilton Standard 43E60-381 propellers.

Times on both engines since last overhaul were: No. 1,635 hr., and No. 2, 471 hr., with 1,199 hr. and 309 hr. on Nos. 1 and 2 propellers, respectively.

West Coast Mid-Air Crash May Bring Traffic Change

Mid-air crash at night in clear weather at about 2,500 ft. of Military Transport Service DC-6 and Navy P2V patrol bomber in the congested Norwalk area near Los Angeles International Airport is likely to bring requirement for single traffic controller for airports from which the two planes took off.

C-118 was cleared for takeoff by CAA control tower operator at Long Beach Municipal Airport.

P2V was cleared for departure by Navy tower at Los Alamitos Naval Air Station. Airports are approximately 6 mi. apart.

Planes took off within one minute of each other and crash occurred 6 min. later.

Lights of planes could easily have blended into background of ground lights to make visibility confusing. One of two Navy survivors of the crash who was conscious after crash was unable to say what happened.

WHO'S WHERE

(Continued from page 23)

Changes

William J. Kunz, Jr., engineering manager, Aircraft Engine Equipment Section, Bendix Products Division, Bendix Aviation Corp., South Bend, Ind.

James E. Duff, general sales manager, Electrical Products Division, Joy Manufacturing Co., St. Louis, Mo.

John C. Huffman, Jr., sales engineering representative (Washington, D. C.), Aeroproducts Operations, Allison Division, General Motors Corp., Indianapolis, Ind.

Wesley L. Guiles, manager, Flexible Tubing Corp.'s Research, Development and Test Center, Guilford, Conn.

Louis De Lalio, chief research and development engineer, Filtors, Inc., Port Washington, N. Y.

A. J. Lilly, director of sales, Canadair Ltd., Montreal, Canada. Also: **Karl H. Larsson**, director-commercial aircraft sales; **Arthur G. Sims**, director-military aircraft and missiles sales; **Louis S. Adamson**, director-service, parts sales and special projects.

Darrell C. Karl, operations manager, Inland Testing Laboratories, division of Cook Electric Co., Chicago, Ill.

Philip Rosenberg, director-Mechanics Research Department, American Machine & Foundry Co., Chicago, Ill.

Myron G. DeFries, head-chemistry group, Atlantic Research Corp., Alexandria, Va.

George F. Bullard, assistant work manager, Kaman Aircraft Corp., Bloomfield, Conn. Also: **Charles W. Robinson**, production manager-Bloomfield area operations; **William H. Heffernan**, production manager, and **Matthew J. Kiely**, manufacturing engineer-Moosup operations.

Guy Martin, sales manager, Microdot, Inc., South Pasadena, Calif.

T. T. Hinman, assistant general sales manager, and Walter H. Snyder, military sales department manager, Lockheed Aircraft Service, Inc., Ontario, Calif.

Robert J. Hostetter, sales manager, Kochler Aircraft Products Co., Dayton, Ohio.

Albert J. Weatherhead, III, plant manager, The Weatherhead Co., Cleveland, Ohio. Mr. Weatherhead will direct all manufacturing activities of the Special Products Division.

Andrew A. Mueller, chief of Engineering Laboratories, Chicago Aerial Industries, Inc., Melrose Park, Ill.

Paul E. Lorentzen, manager, Magnetics Division, Networks Electronic Corp., Van Nuys, Calif.

Gwynn H. Robinson, assistant to the vice president and general manager, Northrop International, division of the Northrop Aircraft, Inc., Beverly Hills, Calif.

James H. Moore, general manager, NRC Equipment Corp., subsidiary of National Research Corp., Newton, Mass.

Alan R. Gruber, assistant chief engineer-nuclear systems research, Astro, division of Marquardt Aircraft Co., Van Nuys, Calif.

D. J. Gribbon, director-manufacturing branch, Missile Systems Division, Lockheed Aircraft Corp., Sunnyvale, Calif.

Charles W. Sanford, vice president-manufacturing, Crouse-Hinds Co., Syracuse.

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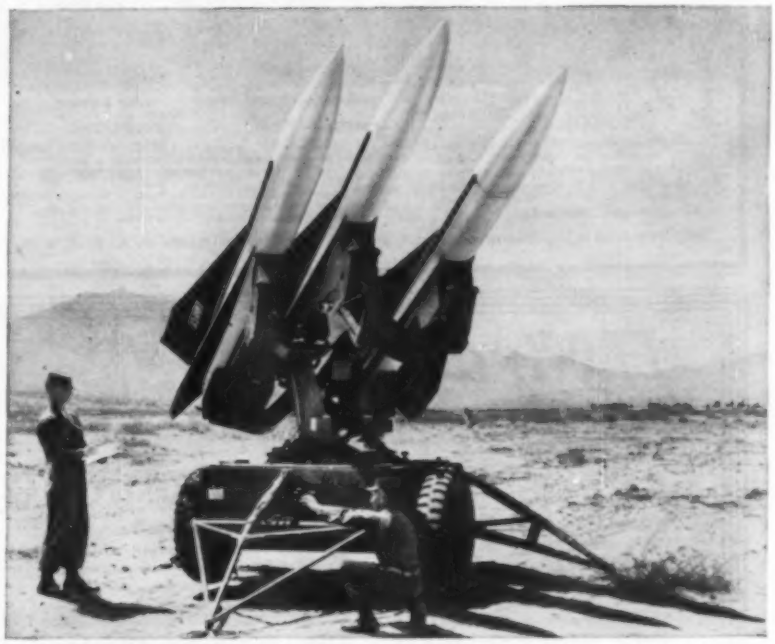

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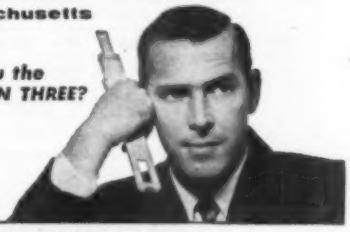

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P-7203, Aviation Week, 68 Post St., San Francisco 4, Calif.

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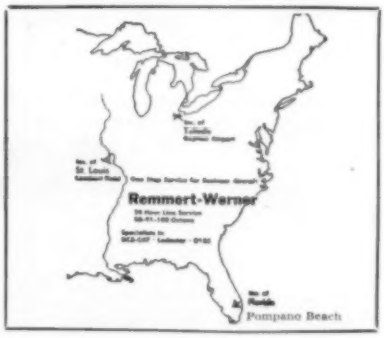

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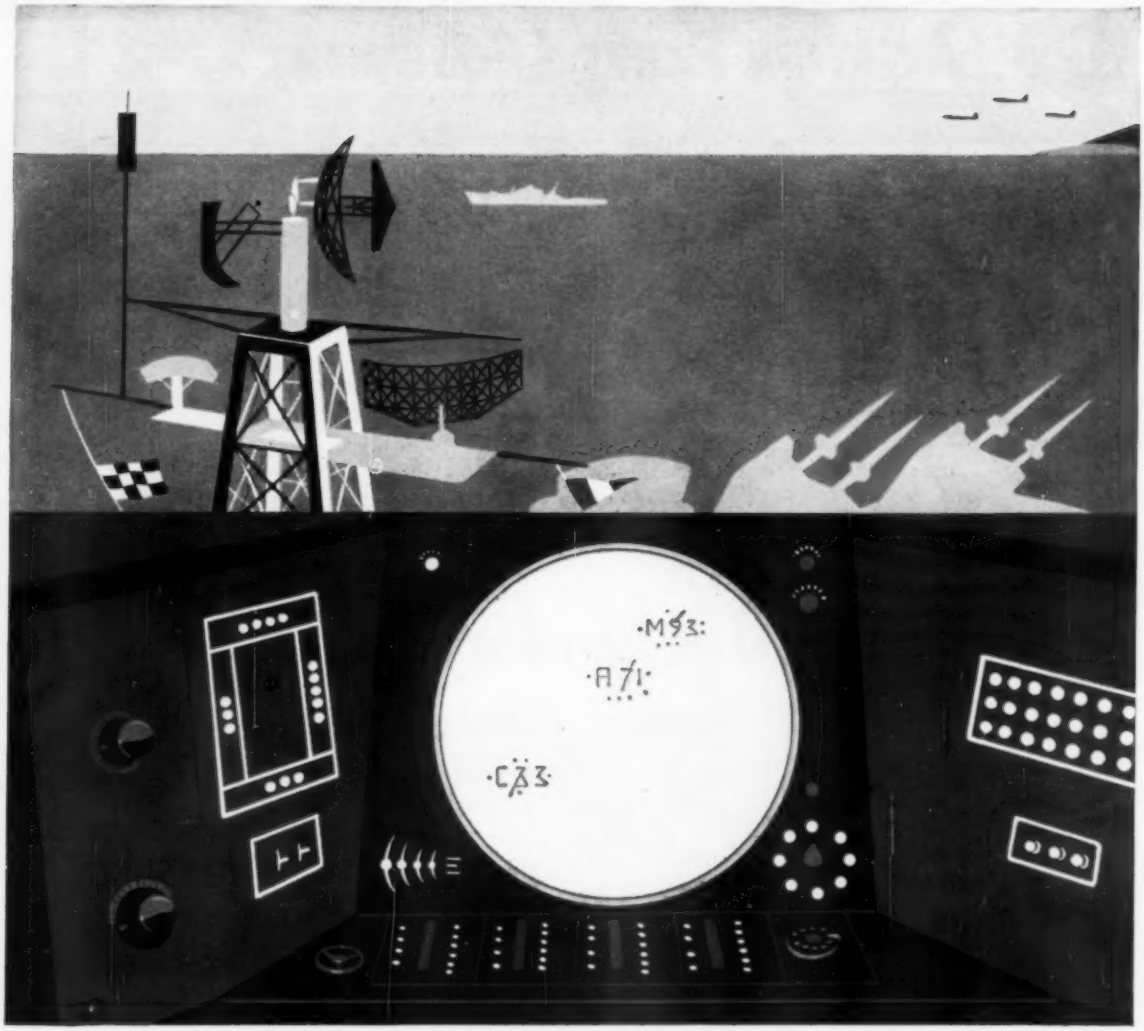

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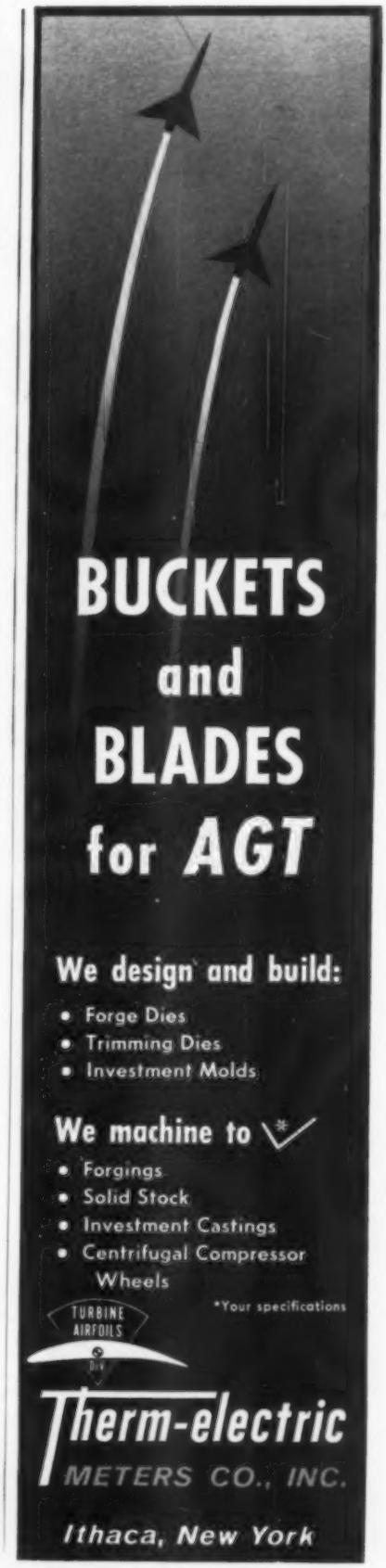

LETTERS

Unfair Distortion

As one who has admired your publication through many years, I was surprised at the unfair distortion which was presented in your "Washington Roundup" (AW Dec. 30, p. 17). The paragraph to which reference is made was captioned "Bureaucratic Pyramid."

In this paragraph the Office of the Assistant Secretary of Defense for Supply and Logistics was represented as having a staff of more than 250 people whose job was to "overlook" the armed forces in certain areas —a statement which was more accurate than even you imagined, according to its current modus operandi.

"By contrast," you mentioned the Office of the Assistant Secretary of the Air Force for Materiel as having 26 persons—intending to convey to your readers that these two facts added up to an organizational oddity.

As one who has worked with both of these organizations, let me provide you with a bit of additional information which may help you to correct this distortion, if such is your desire.

The OASD (S&L) staff mentioned above represents the total organization which establishes policies for the Army, Navy and Air Force in areas such as procurement, production, supply and transportation. This staff is very efficiently utilized, and tackles the monumental job of getting the military departments to coordinate their activities in these fields.

The staff of the Assistant Secretary of the Air Force for Materiel, on the other hand, represents a minute percentage of the Air Force personnel engaged in similar operations. Essentially, they are involved in the approval or disapproval of recommendations which are prepared for them by personnel of the Air Materiel Command whose staff runs into the tens of thousands.

A Long-Time Subscriber
Washington, D. C.

Great Sin

I am not a proponent of supersecrecy; however, I must take issue with what I interpret to be the intent of your editorial in the Dec. 16 issue of Aviation Week entitled "Vanguard's Real Success."

Your interesting, instructive, generally well organized article distracts the reader's attention from a potential cause of the Vanguard's failure.

As an engineer who has worked on projects that have had the pressure of deadlines breathing down his neck, I lived every hour in sympathetic reaction to the unnecessary torment the Vanguard's engineers were forced to suffer. This is a personal reaction which does not come vicariously. If you haven't lived it, you don't know it. Although in my experiences there were only a handful of people involved, the anguish became unbearable at times. Consider then the magnitude generated when the whole world is caused to hover about every turn of a screw, every soldering of a wire, every check you made, etc. With this fantastically

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ponderous psychological pressure—it is a miracle anything worked!!

I believe a great sin has been committed by whoever made it mandatory that complete detailed publicity of the Vanguard's launching be permitted. Not necessarily the official who made the particular decision, but rather the motivating source. I am particularly anxious to know how the "power of the American *free* press" was used behind closed doors. Was it as *license* for the selfish generation of news rather than as *freedom* to serve the interests of our country?

In commemoration of this world renowned travesty, I suggest that a memorium of some kind be established for those Vanguard engineers who were forced to needlessly sacrifice their ulcers for the "freedom of the press."

C. F. Fragola
An engineer with no association with the Vanguard or any of its project members.
Roosevelt, N. Y.

Inaccurate Material

As a long-time reader of your magazine, I have developed the highest possible regard for the technical excellence of your articles and the timely nature of the material you present to your readers. It is seldom that I find material presented in your magazine which is to my knowledge inaccurate or even inadequate. However, your issue of Sept. 30 contained an article which I feel could have been improved to make it more completely comprehensive and perhaps more fair to all concerned.

I refer to your article entitled "Infrared Simulates Aerodynamic Heating" (p. 81). If this article were to have specifically described a system developed by Westinghouse or to have specifically pertained to a sales symposium recently held by Westinghouse and if this article were to have been so labeled, I feel that I could have no criticism. However, the article is so written that it suggests that it is a general survey of the field of high temperature simulation of aerodynamic heating and if it was actually a general survey, I feel that a better cross section of available information should have been obtained.

The article stated that our company is among those selling components and is considering the offering of "integrated systems" later. I feel that we have sold as many components and are as deeply involved in integrated systems as any of the manufacturers mentioned in this article. If the author is as much of an avid reader of your magazine as I am, he might have noted that in your July 22 issue of Aviation Week we filled the entirety of p. 110, at no inconsiderable expense, with an advertisement of our "integrated systems" and he could readily have contacted us to have obtained a complete description of all the equipment that we offer.

In addition to the fact that our company has supplied a large amount of this type of equipment and received only incidental mention in the article, I note that General Electric received even less attention and I can assure you that the company is in this business very deeply and could, I am sure, have added appreciable technical information to a general article on aerodynamic heating simulation.

In any event, this article has presented material on something that is extremely timely and will undoubtedly be getting increasing attention in the engineering field in the future as speeds increase and structural problems due to aerodynamic heating become correspondingly more complex.

K. G. Anderson
President
Research, Inc.
Hopkins, Minn.

Cold Facts

Having read Mr. James Rarick's letter in the Dec. 30 issue of Aviation Week (p. 102) and the many comments made in open letters in your issue of Jan. 27 (p. 122), there is one which very eloquently and factually emphasizes the cold and unadulterated facts entitled, "Thesis Challenged," by Charles F. McMorrow of Haddon Hgts., N. J.

My reaction to Mr. McMorrow's letter is "AMEN." I concur in every respect.

Hugh C. Robbins, President
Robbins Aviation
Los Angeles, Calif.

Standing Up

I am standing up and emphatically wish to be counted!

Steven J. Viscovich
Los Angeles, Calif.

Lights On

With reference to the CAB accident report published in the Jan. 6 Aviation Week (p. 96), my recommendation for reducing the likelihood of mid-air collisions is for aircraft to operate position lights at all times—not just at night and during reduced visibility.

A trip to the airport during daylight marginal weather conditions (when the cool heads have their lights on) will demonstrate to anyone that position lights always make an aircraft easier to see. This is particularly true of the red flashers on newer equipment.

An additional comment, based on my past experience as a naval aviator, is that all aircrews should remember to keep looking around while they are in the process of having a near miss. On a few occasions I have diverted my attention from a first threat just in time to avoid running into someone else.

Robert L. McIntyre
Stony Brook, N. Y.

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